WORLD BANK
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# MENA QUARTERLY ECONOMIC BRIEF

# WHITHER OIL PRICES?

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The MENA Quarterly Economic Brief is a product of the Chief Economist's Office of the Middle East and North Africa (MENA) Region of the World Bank. It supplements the World Bank's semi-annual MENA Economic Monitor with a real-time review, using high-frequency data, of selected countries or issues in the MENA region.

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# Abbreviations

| | |
|---|---|
| ARAMCO | Saudi Arabia State-Owned Oil Company |
| b/d | Barrel a Day |
| CCS | Carbon and Capture Storage |
| CFLs | Compact Fluorescent Lamps |
| CPI | Consumer Price Index |
| EIA | U.S. Energy Information Administration |
| EIU | Economist Intelligence Unit |
| FDI | Foreign Direct Investment |
| GCC | Gulf Cooperation Council |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GNC | General National Congress |
| HCFC | Hydro Chloro Fluoro Carbons |
| ICE | Intercontinental Exchange |
| IEA | International Energy Agency |
| ILS | Innovative Lightening Solutions |
| IMF | International Monetary Fund |
| INDCs | Intended Nationally Determined Contributions |
| IPO | Initial Public Offering |
| JCPOA | Joint Comprehensive Plan of Action |
| KAPP | Kuwait Authority for Partnership Projects |
| KEEP | Energy Efficiency Program |
| KD | Kuwaiti Dinar |
| KRG | Kurdistan Regional Government |
| LED | Light-Emitting Diode |
| LHS | Left Hand Scale |
| LNG | Liquefied Natural Gas |
| LYD | Libyan Dinar |
| MENA | Middle East and North Africa |
| M/T | Metric Tonnes |
| MtCO2e | Million Metric Tons of Carbon Dioxide Equivalent |
| NGLS | Natural Gas Liquids |
| NDIC | North Dakota Industrial Commission |
| NYMEX | New York Mercantile Exchange |
| OECD | Organization for Economic Co-operation and Development |
| OMR | Omani Rial |
| OPEC | Organization of the Petroleum Exporting Countries |
| PPP | Public Private Partnerships |
| p/b | Per Barrel |
| RHS | Right Hand Scale |
| SOEs | State Owned Enterprises |

| | |
|---|---|
| SMEs | Small and Medium Enterprises |
| SWF | Sovereign Wealth Fund |
| U.K. | United Kingdom |
| UNFCCC | United Nations Framework Convention on Climate Change |
| U.S. | United States |
| VAT | Value Added Taxes |
| WTI | West Texas Intermediate |

# Introduction

Since September 2014, world crude oil prices have fallen by more than half, setting a new low at $30 a barrel (Brent crude) in February 2016. Since then, prices rallied to $50 a barrel in May due to supply disruptions in Nigeria and Canada, and the seasonal increase in demand in the summer. The recent recovery did not hold because global stockpiles remain well above historical averages; Iran and Iraq are increasing production; and Russia and Saudi Arabia, among others, are producing at their highest levels since January 2016. Even if the recovery is sustained, there is less chance that prices will revert to the triple digits observed during 2011-13 because of fundamental changes in the behavior of market players. In particular, with 4,200 idle oil wells (the backlog of unfracked wells) and a reaction time in ramping production up or down of about 4 to 6 months—compared with several years for conventional producers—the US shale oil industry may be the marginal producer. And Saudi Arabia appears to have relinquished its role as the swing producer who absorbs fluctuations in global demand and supply.

Clearly, the oil market has entered a new normal. This report seeks to understand the factors behind the new normal to discern the evolution of world oil prices in the future, and their implications for the economies of the Middle East and North Africa (MENA). We begin by trying to explain the oil price crash of 2014, noting that it was preceded by a significant increase in the size and frequency of volatility of oil prices. This volatility in turn contributed to the accumulation of oil inventories that many observers, including the U.S. Energy Information Administration (EIA), attribute to the decline in oil prices. Noting that, historically, oil price slumps have lasted longer than spikes, we suggest that the current situation may persist because of the changing behavior of market players, and the fact that overall oil demand is weak and not expected to rebound anytime soon. Indeed, we find that the correlation between oil production and prices, which used to be positively-sloped, has turned negative: a decline in oil prices is met by an increase in production. In the absence of a pickup in demand[1], this situation can result in rising oil inventories going forward.

Putting these findings together, we expect the world oil market to work through its current oversupply and rebalance in early 2020 at market-clearing prices that are close to the marginal cost of the last producer (US shale oil producers or another swing producer). Oil prices are likely to be in the range of $53 - $60 a barrel. Prices higher than the upper bound would encourage drilling rigs leading to another supply glut; prices below the lower bound would prevent them from entering the market. However, risks to the timing of market rebalancing remain high, stemming from an expectation of lower demand (see Footnote 1) and continuation of the oil glut.

[1] Preliminary estimates by the World Bank show that the recent vote in favor of the U.K.'s leaving the European Union is likely to slow global growth even further.

The new normal for oil prices will prove difficult for MENA's oil producers, as they are well below the prices needed to balance budgets. Break-even oil prices have increased substantially over time due to governments' high spending during the boom years particularly after the 2011 Arab Spring where governments of both oil-exporting and importing countries increased subsidies and the public-sector wage bill. For example, Saudi Arabia introduced a welfare package worth of $93 billion. Oil importers such as Tunisia and Egypt, buoyed by remittances and aid from oil-exporting countries, also raised subsidies and civil-service wages.

The sharp drop in oil prices in 2014 is changing this picture. Oil wealth has been used to support the existing social contract between the state and citizens, where the former provided fuel and food subsidies, free health and education, handouts and public sector jobs in return for muted citizen voice and limited accountability (Devarajan and Mottaghi, 2015). That contract is fraying. Governments throughout the region are taking measures long considered impossible such as imposing taxes, eliminating fuel subsidies and reducing public sector jobs and salaries. Almost every oil-exporting country is cutting subsidies to fuel, electricity, gas, and water (Devarajan and Mottaghi, 2016). Even oil importers such as Morocco, Egypt, and Jordan, who started reforming subsidies in 2014, are shifting from a fixed domestic price of fuel to one that is tied to the world price. Many are cutting public spending and some, like Algeria, are freezing public-sector hiring. Morocco and several GCC countries have introduced energy-efficiency improvements, lowering carbon emissions. These reforms, if sustained, could enhance the efficiency of MENA economies going forward.

## Explaining the 2014 Oil Price Crash

To understand how oil prices may evolve in the future, we begin by looking at the factors behind the current slump. Oil prices are extremely volatile in the short run, but in the long run (over the past 4 decades) the oil market has witnessed only five major boom and bust episodes.[2] The three large spikes in oil prices each lasted 6 years on average. In 1974, the Brent crude oil price quadrupled (due to the Arab oil embargo), from $2.80 a barrel a year before. Oil prices tripled again in less than six years, hitting $32 a barrel in 1979 due to the geopolitical tensions arising from the Iranian Revolution and the start of the Iran-Iraq war. They remained around that level before plunging by more than half in 1986. Oil prices only started to recover in 2005, doubling the 1999 level, exceeding $100 a barrel for three years, 2011-13. The three booms resulted mainly from geopolitical developments and expectations of a sudden cut in the supply of oil.

Two major crashes occurred in 1986 and 2014, with the former lasting eighteen years and the latter almost three years (so far). Both slumps (1986 and 2014) were supply-led, resulting from

[2] For a case study of previous episodes and the role of demand and supply factors in the oil price plunge also see Baffes, Kose, Ohnsorge and Stocker (2015).

an increase in non-OPEC (Organization of the Petroleum Exporting Countries) oil production together with actions taken by OPEC countries trying to retain their market shares, while demand remained muted. Besides these two, there was a short lived demand-led crash in 2008 at the onset of the Great Recession, but prices rebounded quickly as global demand for fuel surged.

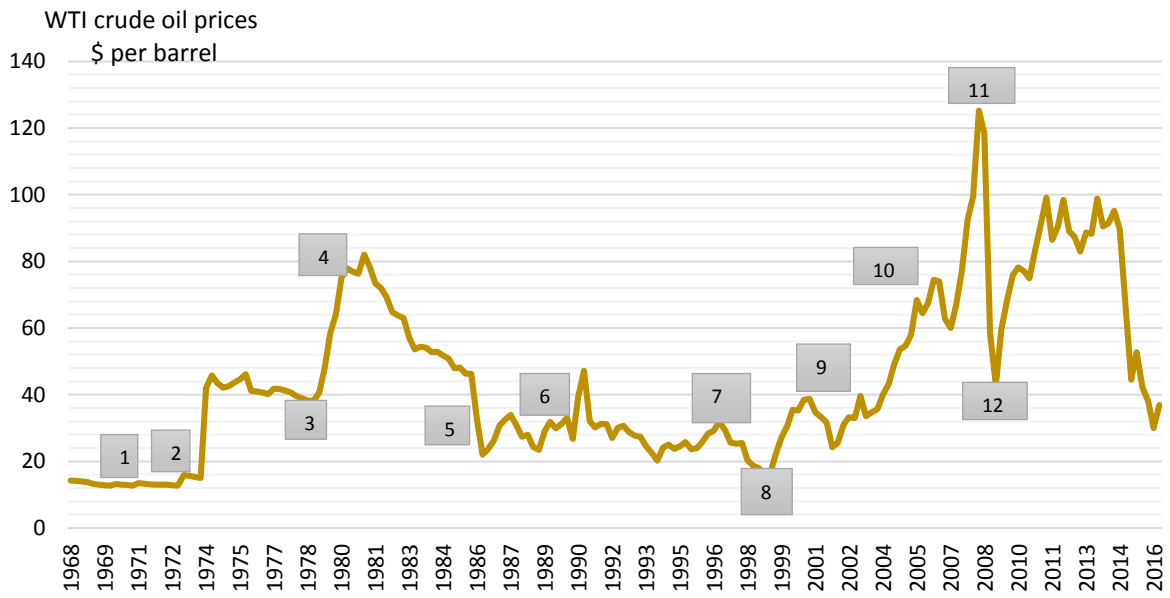
**The Role of Demand and Supply.** A closer look at the 2014 oil price slide reveals the following factors as the most important. Demand for oil has remained weak over the last two years due to a slowdown in Europe and Asian countries. China's demand for oil which grew by the equivalent of Japan and the United Kingdom (U.K.)'s total oil consumption in 2013, fell sharply in 2014 as its economy slowed down along with Europe's and those of some other countries in Asia. Using a simple econometric model, Hamilton (2015) showed that about 42 percent of the sharp drop in oil prices between September and December 2014 can be attributed to a decline in global demand due to slower growth in Europe and parts of Asia. On the supply side, the oil market has been facing a supply glut of about 1.5 million b/d, which is not going to wear off any time soon due to the factors which we will discuss next.

**Volatility of Oil Prices.** The supply and demand for oil are set by market as well as non-market conditions that are not pre-determined, making oil prices extremely volatile compared to all other commodities. More than other commodities, oil is frequently used as a tool for financial investment, hedging, and speculation. The dominant role of the Intercontinental Exchange (ICE)[3] in London and New York Mercantile Exchange (NYMEX) in trading futures contracts in two grades of crude oil – West Texas Intermediate (WTI) and North Sea Brent -- shapes expectations for oil prices. The magnitude of purchases of crude oil futures contracts by speculators creates an additional demand for oil that could drive up prices in the same manner that physical demand acts in the spot market. If prices are expected to be higher in futures contracts, oil companies are motivated to buy more oil and store them, increasing fluctuations in demand, volatility and inventory pile up.

In addition, oil has been used as a tool in international politics and currently plays a strategic role in the foreign policy of major oil producers. The 1973 Arab oil embargo, 1979 Iranian revolution and 1980 Iraq-Iran war, and recently the embargo by the US and Europe against Iraq, Iran and Libya, are but a few examples. Between 1970 and 2010, there were at least twelve events that shaped the shocks to the oil market (see Figure 1). The value of the U. S. dollar is another factor negatively correlated with oil prices. A weakening of the dollar (in which oil prices are denominated) could push oil prices higher while a strong dollar could work the opposite way.

[3] ICE Futures in London began trading futures contract for WTI crude oil, a type of crude oil that is produced and delivered in the United States, in January 2006.

**Figure 1. Geopolitical and Economic Events and Crude Oil Prices**




These events are: 1: US spare capacity exhausted, 2: Arab Oil Embargo, 3: Iranian Revolution, 4: Iran-Iraq War, 5: Saudis abandon swing producer role, 6: Iraq invades Kuwait, 7: Asian financial crisis, 8: OPEC cuts production targets 1.7 (million barrel a day (b/d)), 9: 9-11 attacks, 10: Low spare capacity, 11: Global financial crisis, 12: OPEC cuts production targets 4.2 (million b/d).

Sources: U.S. Energy Information Administration (EIA) and Thomas Reuters. Last updated 06/30/2016, quarterly data. Note: The real oil prices are calculated using the headline CPI, 2010=100.

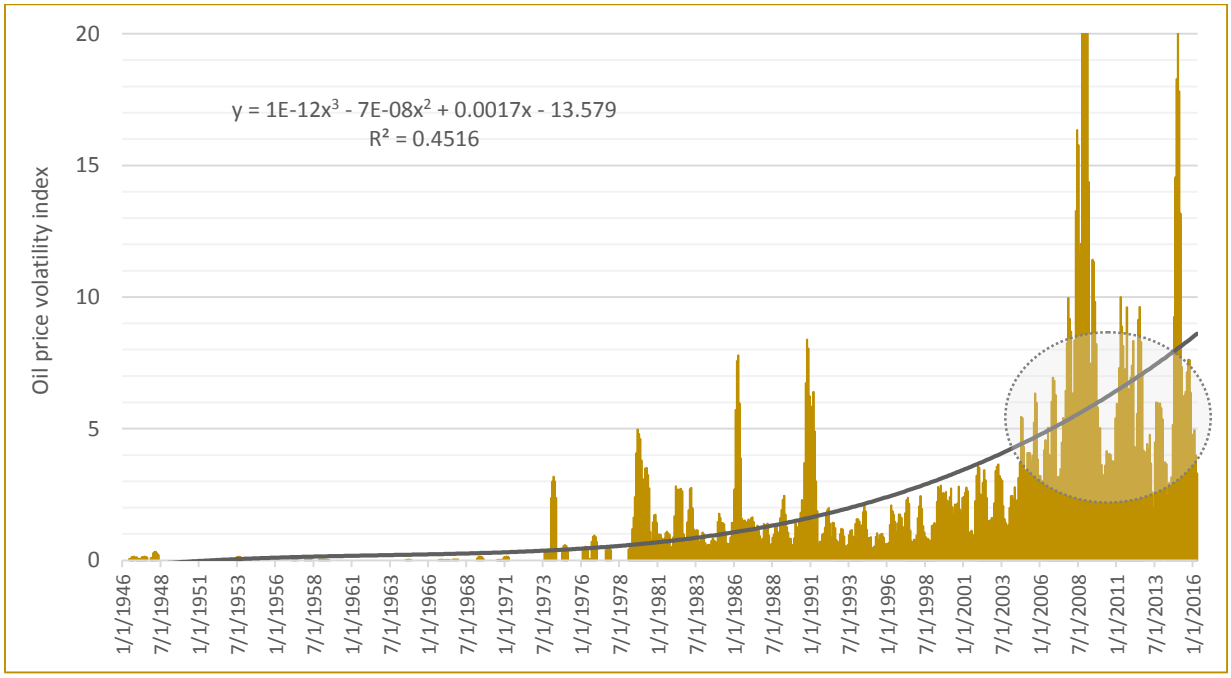
To explain the magnitude of volatility in the oil market, we calculate an index for volatility for the period of 1946-2016 by taking monthly data for real Brent crude oil prices. The calculated index, which is the standard deviation of monthly oil prices in a six-month period, rolling over to the rest of the periods, is plotted in Figure 2. The trend of the index of oil price volatility tends to take the form of a third-order polynomial equation that best fits the scatter plot (Black line – Figure 2).

Looking at the evolution of the oil market in Figure 2, it appears that the oil market was stable during the period 1946-1970. During this time, oil was not considered a tool for political or speculation purposes. Volatility kicks in after 1970 as we observe five spikes in oil prices between 1970 and 1991, and levels off afterwards.[4] Breaking the period at 1991, one can see that the spikes of 1972 to 1991 follow a pattern of the business cycle (repeating every 6 years or so) but the pattern changes as we move towards the present. Volatility starts to increase sharply in 2006, peaking in 2008. The 2008 uptick is the sharpest spike in oil volatility of the past 43 years. This may be due to the unpredictability of futures prices and the fact that oil prices not only reacted

[4] Increased volatility led to a need for mechanisms allowing producers and consumers to hedge that volatility. These all progressed into bilateral, futures and option contracts adding to the complexity of the market.

to quantities demanded and supplied, but to uncertainty in the market, changes in investors' appetite, and specific geopolitical and economic events during this period.

**Figure 2. Oil Price Volatility**




Sources: World Bank and MACROTRENDS.

The pattern of volatility changes as we move beyond 2008 with a rising trend in frequency and speed in the volatility index. The volatility index during 2005 and 2006 averaged around 4.3 percent; during 2008 this number was 15.5 percent. Volatility remained high afterwards particularly during the last quarter of 2014 staying at double digits and the trend continues into 2015. The volatility index peaks in the first quarter of 2015 as shown with the large spike in Figure 2. This was accompanied by a sharp decline in the spot price itself. Comparing the two price slumps, it appears that volatility post 2014 is much higher in terms of frequency and speed compared to the oil price slump in 1986, where the volatility index averaged 3.5 percent in 1986. Volatility, the rate of production and inventory levels are interrelated.[5] Volatility affects inventories and vice-versa. In a May 2016 article, the EIA concludes that crude oil inventories are one of the reasons for oil price volatility. Meanwhile, Pindyck (2004) argues that changes in volatility can affect the marginal value of inventories--the opportunity cost of producing oil now rather than waiting. Competitive producers hold inventories to reduce the costs of adjusting

[5] Inventories are normally held to respond to fluctuations in demand. The idea of "strategic reserves" was first introduced in the aftermath of the oil price shock of the 1970s. The strategic oil reserves were intended to provide oil supplies in periods of "supply disruptions" (Krapels, 1980). Inventories are now held for speculative purposes (when one expects futures prices to be higher than current prices), thus increasing demand for inventories.

production. Using a structural model of production for three commodities in two markets, Pindyck explains how volatility in oil prices, rates of production, and inventory levels are interrelated. He argues that price fluctuations (whether caused by fluctuations in net demand or something else, such as speculative buying and selling) will cause consumption and production to fluctuate. Thus an increase in price volatility will be accompanied by an increase in the volatility of production and consumption. This in turn implies an increase in the demand for storage; at any given level of storage, market participants will want to hold greater inventories in order to buffer the fluctuations in production and consumption. The result will be an upward shift in the demand for inventories.

Historical data tend to support the second argument. Oil inventories stored at Cushing in Oklahoma[6] - where prices for WTI crude oil prices futures contracts are set - and WTI crude oil for the period of January 2014 to March 2016 are shown in Figure 3. Oil prices are negatively correlated with the volume of crude oil stored at Cushing. From January 2014 to August 2014, inventories declined sharply and oil prices were at their highest levels, exceeding $100 a barrel. As high prices encouraged drilling, production from both conventional and US shale oil producers increased, with the latter increasing faster. As discussed earlier, this is the period when the pattern of volatility in oil prices changed dramatically.

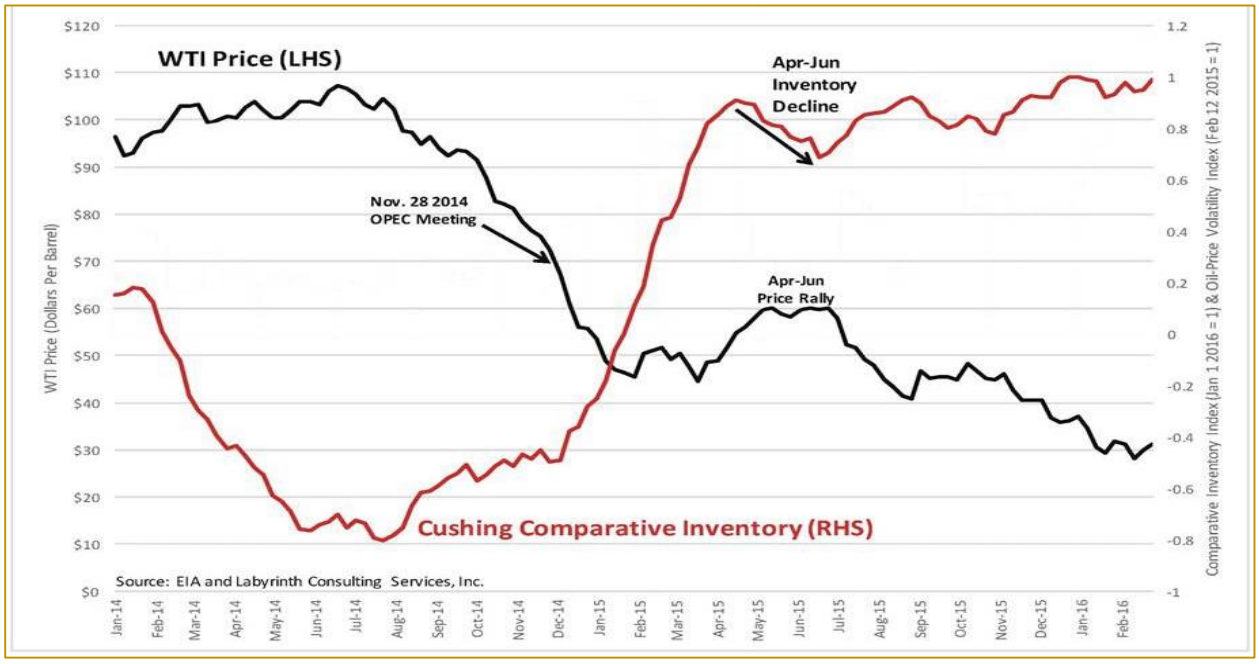
It appears that the rise in uncertainty has led to an increase in volatility in the market, leading to a huge inventory buildup. Quite simply, a more volatile market increases demand for inventories to be able to meet market disruptions. OPEC's decision in November 2014 not to cut production caused a spike in volatility with a few more spikes afterwards which led to a sharp rise in oil stockpiles in April 2015. While inventories declined slowly in April and June, the rising trend continued till February of this year. To better understand the correlation between volatility, inventory levels and the rate of production, we now examine the correlation between oil prices and production of oil.

**Inventories, Oil Prices and Production.** Equilibrium prices in the oil market are determined by the intersection of demand and supply curves. Due to the nature of oil, there is a lag between price changes and adjustments in production and consumption of oil. In other words, demand and supply for oil are inelastic in the short run. Various factors, such as the level of spare capacity or inventories, can explain why the price elasticity of demand and supply might be lower in specific periods. Estimates of elasticities range between -0.05 for the short-run and -0.30 for the long-run for demand and between 0.04 (short-run) and 0.35 (long-run) for supply. The U.S.

[6] Cushing, Oklahoma is the largest oil storage tank farm in the world. It has 73 million barrels of working capacity, about 13 percent of U.S. storage. More than 3 billion barrels of WTI oil futures contracts are traded weekly. A few of these contracts result in delivery of physical oil. Instead, most contracts are sold forward (Source: Oilprice.com).

Energy Information Administration (EIA) and System Sciences Inc. estimate less elastic supply curves—0.02 for the short-run and 0.10 for the long-run.

**Figure 3. Cushing Comparative Inventory and Oil Prices**



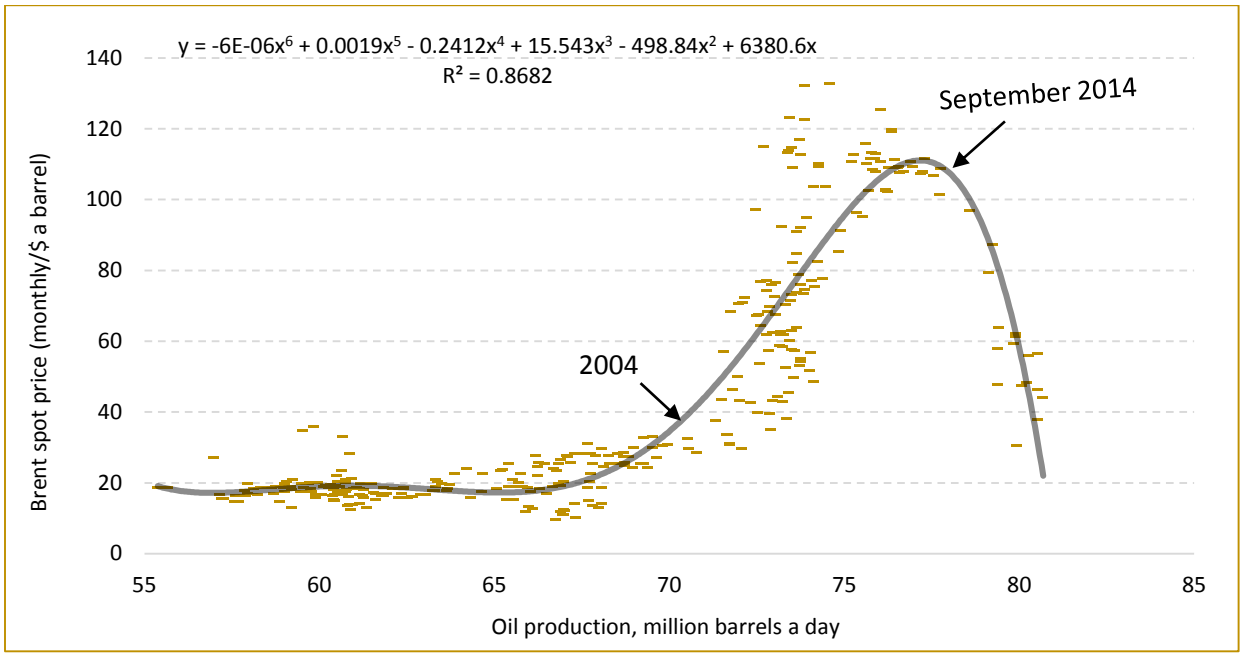

Sources: EIA and Labyrinth Consulting Services, Inc.

To explain the behavior of oil producers in the market at any specific time, we have constructed the trend line for oil prices and production using monthly data for the period of May 1987 – January 2016, where data were available. Figure 4 plots the world total oil production (million b/d) against the Brent crude oil prices, $ per barrel (p/b) using observable data. The equilibrium price at any point in time reflects the intersection of the supply and demand curves. The trend line tends to take the form of sixth order polynomial equation that best fits the scatter plot (Black line - Figure 4).[7]

Looking at Figure 4, it appears that there are three distinct phases: Prior to 2004, the trend line is flat - a small rise in price led to a large rise in production. This is explained by OPEC's behavior and in particular the unique position of Saudi Arabia's playing the role of "swing producer", absorbing fluctuations in supply and demand in order to keep the market and price stable (see Box 1). From 2004 to the first half of 2014, the slope of the trend line becomes much steeper, where small rises in the price are not associated with corresponding increases in production.

[7] The polynomial of order 6 fitted the data better as shown by its high value of $R^2$ that is close to 90 percent.

**Figure 4. Correlation between Oil Prices and Production (May 1987 – January 2016)**




Source: Data from EIA and Ycharts.

We also see an increase in the magnitude of volatility in oil prices after 2004 peaking in 2008 (see Figure 2). The spike in oil prices in the first half of 2008 could be explained by movements (increase) in demand as production was not responding fast enough to the corresponding change in prices. The reason is that OPEC members lacked sufficient capacity - after years of restrained investments - to bridge the growing gap between global demand and non-OPEC supply. The sharp price decline in the second half of 2008 is explained by a sharp drop in demand as the financial crisis hit the global economy. Thus the primary factor making large swings in oil prices during this period was fluctuations in demand for oil.

The interesting feature of the trend line is its backward flip starting in September 2014, where a drop in prices is met with an increase in supply (see Figure 4). This is the current situation in the oil market where oil production is rising and demand is stagnant. Due to short run rigidities and the high cost of adjustment, producers and particularly high-cost producers keep producing until revenues are less than the marginal cost of production. They are trying to cover at least their variable costs (as opposed to the fixed cost) which vary significantly from $5 a barrel in Saudi Arabia to $60 a barrel and more in US unconventional shale oil (see Cost break-even oil prices section).

**Box 1. The Role of Saudi Arabia as a "Swing Producer"**

The importance of OPEC's behavior, its functioning and more importantly Saudi Arabia's dominance have been the subject of much research. In the literature, there are two sets of models explaining the behavior of OPEC countries. First, those that do not recognize OPEC as a cartel of different-sized oil producers, and therefore Saudi Arabia's role as a "swing producer". These models are grouped into two, the monolithic cartel model of Gilbert (1978), Pindyck (1978) and Salant (1976), and the competitive model of MacAvoy (1982). A second set of studies examine the role of Saudi Arabia as a swing producer dominating decision-making in OPEC and hence oil prices in the international market. While the results are mixed, it appears that the models explaining the role of OPEC as a price maker, particularly throughout the 1970s, 80s, 90s and 2000s, have gotten some support. For instance, Gilbert (1978) models OPEC's behavior as the dominant producer, a Stackelberg leader and the price maker, with the other producers as the price-takers.

Böckem (2004) applies New Empirical Industrial Organization theory and concludes that OPEC behaves as a price-leader while all other suppliers are price-takers. Huppmann and Holz (2012) examined whether Saudi Arabia acts as the Stackelberg leader within OPEC under a number of market power scenarios ranging from perfect competition to cartel. They developed a numerical simulation model that allows for the possibility of strategic interaction among the players. Results show that if Saudi Arabia acts as the Stackelberg leader, it produces at full capacity, thereby benefiting from a combined quantity and price effect. This result strongly points to the conclusion that Saudi Arabia indeed has been dominating the global crude oil market prior to the current slump.

What has changed since the price crash of September 2014? One of the problems in OPEC has been cheating on their allocated quotas by the members. The problem has been exacerbated since 2014 with Iraq's rebuilding its productive capacity and Iran's planning to flood the market with an extra 1,000,000 barrels b/d post sanctions. In fact Iran plans to double output to 6 million b/d by end of decade. A cut of 1.5 million b/d is needed to balance out the excess supply in the market - the equivalent of a 5 percent cut in oil production among the member countries (OPEC's total production is about 32 million b/d).

In this game, if Riyadh were able to keep its leadership role as "swing producer" and absorb fluctuations in supply, then they would be the one bearing the brunt of cutting oil production as they have done in the past. This will leave them with lower production relative to other members in an already low oil price environment, opening the door for long-term financial strain. Instead, it appears that they chose to maintain market share, instead of fighting for OPEC leadership. Furthermore, US shale oil had already proved to have huge spare capacity to respond rapidly and efficiently to market turbulences (see section on oil market rebalancing).

## Oil Market Rebalancing

Now that we have a better idea of the factors that contributed to the post-2014 decline in oil prices, how long will the slump last? To answer this question, we first look at the experience of previous oil busts, and then turn to the current situation and the factors that will cause the oil market to rebalance.

**The Experience of Previous Oil Busts.** As discussed earlier, oil busts last longer than booms. The reason lies in the slope of the supply curve which is relatively inelastic particularly in the short term (see Figure 4, for example). Oil producers (unlike producers of other commodities) do not necessarily respond to low oil prices by reducing their supplies (see previous section). On the contrary, during the bust, some of the high-cost (unconventional) oil producers respond by supplying more to the market just to cover their operating cost and large debt. By the same token, due to their low operating cost, conventional oil producers tend to maintain their market share by producing more oil. For example, OPEC countries have at times abandoned their quotas and produced more than their ceilings to keep their market share. Iraq and Saudi Arabia increased output in June of 2015 due to increased drillings in both countries, exceeding by about 1.28 million b/d OPEC's limit of 30 million b/d. Ample supply in times when demand is muted will put pressure on prices to fall further. A continuation of this situation makes the bust last longer than the booms.

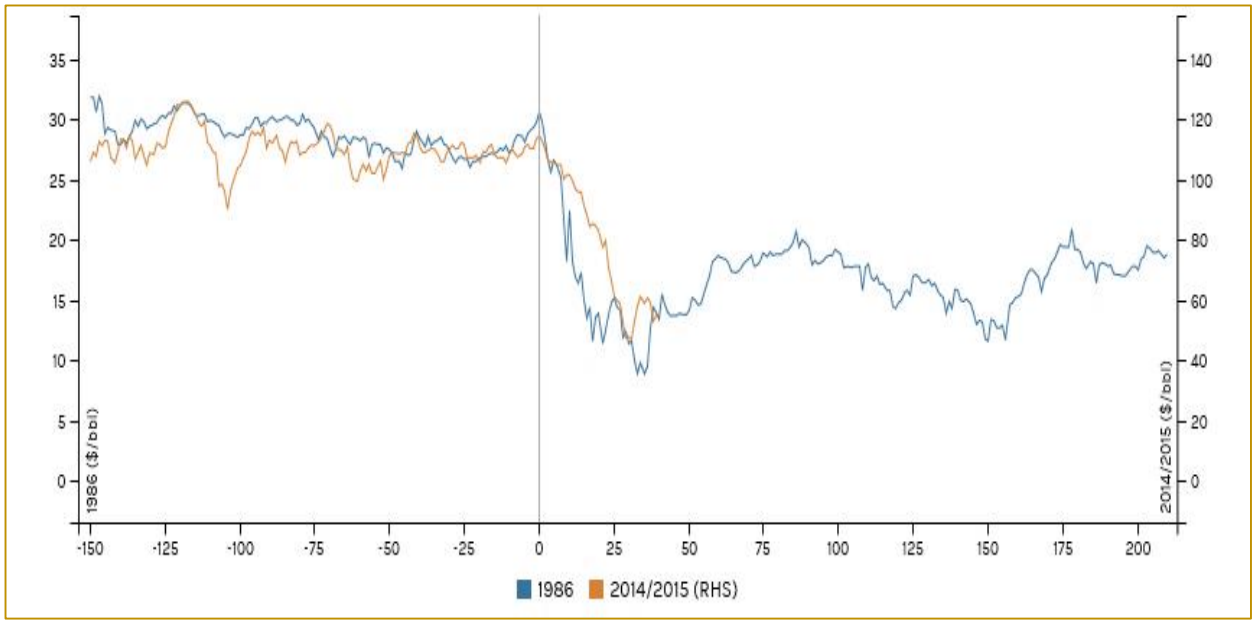
The behavior of oil producers and the speed of their responses to market disruptions will determine the duration of oil busts. Unlike the 1986 oil slump when OPEC and particularly Saudi Arabia drove price movements in the market, US shale oil producers are the swing producers today (see Box 1). Compared to the slow response of conventional oil fields (often several years) the US shale oil industry has sizeable spare capacity and can react to changes in the market with a short lag (often about 6 months).[8] A large numbers of shale oil wells are idle. According to data compiled by Bloomberg Intelligence, at the end of 2015, there were about 4,290 uncompleted wells in the U.S. and 30 percent were confined to two shale regions: the Bakken and the Permian in West Texas and New Mexico. The untapped wells allow the US to increase or reduce production faster than conventional sources as prices get close to a tipping point that triggers or stops production. Data by Baker Hughes show that the number of active US oil rigs decreased to

[8] Conventional oil fields are different than unconventional oil fields where fracking (hydraulic fracturing and horizontal drilling) technology is used. The system includes onshore drilling, shallow water drilling (less than 1,000 feet), deep-water drilling (between 1,000 and 2,500 feet), and ultra-deep-water (greater than 2,500 feet). The commonality between all of these conventional methods is that companies drill vertically below ground (whether underwater or onshore) and hit a reservoir of oil (oil field), then proceed to pump the oil into a well. The system needs huge amounts of investment over 5 to 10 years from extraction to production and maintaining the field.

about 489 in 2016, less than a quarter of the record reached in 2014, causing US oil production to decline by 10 percent in less than a year.

Comparing the price slumps of 1986 and 2014 reveals interesting evidence about the duration of the slumps. Figure 5 traces the price trend in both 1986 and 2014 slumps. Both trend lines follow the same pattern. If historical experience is a guide, it may be sensible to conclude that the current oil slump will last longer than was expected, probably continuing to the next decade.

**Figure 5. Oil Prices Compared, Brent Crude Oil Price ($/barrel)**




Source: Thomson Reuters Datastream. Note: Horizontal axis shows number of weeks before/after the start of the oil price decline.

As discussed, the reason behind the sharp drop in oil prices in 2014 was high volatility observed particularly after 2008 and peaking in 2014 that led to the accumulation of oil inventories at the time where demand was not responsive (due to the global slowdown particularly in China). Therefore, the market will rebalance at a clearing price at which both production and inventories have declined or demand for oil has picked up (or both). We now examine these factors in details.

On the supply side, a consensus to cut production among OPEC producers does not seem likely as Saudi Arabia has relinquished its flexibility as market stabilizer in favor of maintaining market share (see Box 1). Together with other members of OPEC and Russia who are willing to maintain their market share, Saudi Arabia will likely keep producing at the current pace or even more (see last section on MENA countries' responses to low oil prices). Among the others, Iran and Iraq have increased production already and Libya could possibly come back to the market if tensions subside. Moreover, Saudi Arabia's operating costs are low, ranging from $5 to $15 a barrel, which

makes it profitable to produce oil even at the current low prices. Thus, any production cut would come from the swing producers, the role currently played by the unconventional oil producers, especially the shale oil industry. These companies have a "tipping point price" at which they will increase or decrease production rapidly (see next section).

In addition, a sustained increase in demand is needed to boost prices and reduce volatility. Estimates by EIA show that demand rose slowly in May 2016 and Brent crude oil prices enjoyed a rally to around $50 a barrel in May, driven by supply outages in Canada, Nigeria and elsewhere and seasonal increase in consumption, reaching a new high of $53 a barrel during the first week of June. But the rally did not continue due to the existing large supply overhang of close to 1.5 million barrels and Brent crude dipped to $49.3 a barrel on June 15. The Paris-based International Energy Agency (IEA) estimates that demand for oil is not expected to pick up and surpass the supply of oil until 2019 (Table 1).

**Table 1. World Crude Oil Volumes, Million Barrels a Day**

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| World Demand | 94.4 | 95.6 | 96.9 | 98.2 | 99.3 | 100.5 |
| Non-OPEC Supply | 57.7 | 57.1 | 57.0 | 57.6 | 58.3 | 58.9 |
| OPEC Crude* | 32.0 | 32.8 | 33.0 | 33.0 | 33.2 | 33.5 |
| OPEC NGLS etc | 6.7 | 6.9 | 7.0 | 7.1 | 7.1 | 7.1 |
| Total World Supply* | 96.4 | 96.7 | 97.0 | 97.8 | 98.7 | 99.5 |
| Implied Stock Change | 2.0 | 1.1 | 0.1 | -0.4 | -0.7 | -1.0 |

Source: IEA. Medium-Term Oil market report 2016. Note: *OPEC actual output in 2015. Assumes a post-sanctions increase for Iran in 2016 and adjusts for OPEC capacity changes thereafter.

There may be a possibility that demand will pick up and prices rebound in an overly supplied oil environment. This will depend on the income elasticity of demand, since the supply curve is quite inelastic, even in the long run (see Figure 4). Improvements in the prospects of the global economy could boost demand for oil and that could lead oil prices to rebound. However, concerns over climate change, stranded assets and renewable energy issues could dampen the speed of recovery in demand.

Policymakers have generally agreed that it is desirable to keep global warming from exceeding 2 degrees Celsius above the average global temperature of pre-industrial times. If that warning holds, a third of oil reserves, half of gas reserves and over 80 per cent of current coal reserves

will have to remain unused from 2010 to 2050 in order to meet the target of 2 degrees Celsius[9]. In other words, most of the world's oil reserves would end up as stranded assets in the ground. It would then make sense for oil producers to sell as much of their reserves beforehand. A decision to extract and sell now will ultimately add to the existing oil supply glut.

With this background, we turn to the expected timing of the rebalancing and the prices at which the market will clear.

**How Does the Market Rebalance and When?** One scenario is that the oil supply glut will ease over time as high-cost oil producers such as the US shale oil industry leave the market and/or OPEC members come to an agreement to cut production. In this scenario, oil prices will recover, possibly with a delay, even if demand stays mute. But as discussed before, several factors, including Iran's re-entry into the oil market, policy responses from other OPEC countries, Russia trying to keep their market share, and the price at which US shale production becomes profitable (see next section), will likely keep the price recovery on hold at least until 2018.

The latest data from IEA points out that oil production in the MENA oil producers has reached historically high levels, exceeding 31 million b/d mostly coming from Saudi Arabia, Iraq and Iran. Since the embargo on its oil exports was lifted, Iran has added about 750,000 b/d to its output. According to fresh data from the Oil Ministry, Iranian crude oil exports have reached 2.1 million b/d in April 2016, compared to about 1 million b/d in the sanctions era. Policymakers have stated that this policy will continue until Iran regains its pre-sanctions market share. Besides, they have very low operating costs that enable them to stay in the market for some time or even increase production further to compensate for low oil prices. In the absence of a pickup in demand, this will add to the already high levels of inventories. The EIA expects global oil inventories to start showing some signs of decline in 2018 and the following year. This could help prices rebound in the first half of 2019, with prices expected to accelerate later through the end of the decade (see next section).

The current oil price environment has had negative impact on oil investments. The oil industry cut an estimated 42 percent of the total investment during 2015 and 16. According to IEA, North America accounted for about half of the drop. If prices stay low for some time, a significant rebound in investment does not seem likely over the next two years. EIA forecasts for the U.S. production of oil are an average of 8.6 million b/d in 2016 and 8.2 million b/d in 2017. Given the current supply glut, this may not be enough to raise prices in 2017 or even 2018. Therefore, global inventory is expected to build up through the next two years, if demand does not move. Putting all these together, there is a strong possibility that the market rebalances in late 2019 or early 2020.

[9] According to a study by McGlade C., and Ekins, P. (2015), Nature 517, pp. 187-190, January.

## Market Clearing "Threshold" Oil Prices

When the market rebalances, what would the market-clearing oil prices be? In other words, what is the price that is low enough to keep US crude production from rising, thus correcting the supply glut, and still above the break-even prices for these companies? What is the "threshold prices" that triggers US shale oil to raise production? The answer to these questions depends on a few factors.

**Reserves of Shale Oil.** The availability and accessibility of significant shale oil and the shale industry's ability to react quickly to market movements, will affect the rise in global oil prices. Estimates by the EIA suggest that there is potential for shale oil production to reach up to 14 million b/d by 2035 (from 8.7 million in 2015), amounting to 12 percent of the world's total oil supply. With shale's increasing presence in the oil market, even if prices start to rebound (as has been the case since April 2016), analysts do not expect a return to the triple-digit levels seen during 2011-13. The reason lies in the changing behavior of OPEC and US shale oil producers and the speed at which the latter responds to market imbalances. A series of developments in the U.S. shale oil industry and efficiency gains[10] (see Box 2) have led the industry to move quickly to respond to market disruptions while OPEC remains a bystander (see Box 1).

**Cost Break-even Oil Prices.** Compared with the Middle East oil producers such as Saudi Arabia, cost break-even prices for the US shale oil industry are much higher. Though there have been some efficiency gains in the industry, there is still a wide range of break-even prices for different counties (see Table 2), from a low of $30 to about $60 a barrel for some counties such as Eagle Ford. This is because the break-even price is largely a function of the cost of drilling and completing the well and the amount of oil that is ultimately recovered from the well. The amount of oil produced from a well can vary a great deal over the course of just a few miles, so there exist a wide range of break-even estimates for a single shale oil play.

Figure 6 shows long-cycle break-even estimates from several sources. Among the key plays, Permian Midland and Niobrara Shale and Eagle Ford demonstrate the largest decline in break-even prices, among others. All in all, the break-even prices averaged about $60 p/b in the third quarter of 2015 falling by more than 40 percent between 2013 and 2015. They may even go lower with efficiency gains and improvement in technology of drilling wells and extracting.

[10] In 2013-14, a well took about 22 or 23 days to drill and complete and it's been reduced by half (10 or 11 days).

**Box 2. The Science of Shale Oil**

Oil shale contains a substance called kerogen, which is the organic material from which oil is derived. Kerogen cannot be pumped from a reservoir like oil. Instead, the oil shale rock must be heated to separate the liquid. Once the liquid is collected, it can be upgraded to synthetic crude oil for refining using the existing petroleum infrastructure. A well is drilled vertically until just above the target zone, where it curves before it is directed horizontally into the selected shale formation. After the well is drilled, it is hydraulically fractured to allow oil and gas to migrate into the wellbore and to the surface. Hydraulic fracturing is a well-stimulation technique in which rock is fractured by a pressurized liquid. The process involves the high-pressure injection of 'fracking fluid' necessary to achieve adequate flow rates in shale gas, tight gas, tight oil, and coal seam gas wells.

The total time required to drill and complete a well depends on the target depth, the length of the lateral drilling and the geological conditions encountered. A well at the shallower depth range of 4,270 meters (14,000 feet) would take about four weeks to drill, while a well of 6,700 meters (22,000 feet) would take about five weeks. Unlike a conventional oil well, the life of a new well is two years. Its production declines by 70 percent the first year, and by 50 percent the following years. Thus, a well maybe fracked up to 18 times to maintain its production.

Contrary to conventional oil wells which takes years to drill and produce oil, US shale oil takes much less time, probably between 2 to 4 months from drilling to producing oil. This gives the industry the flexibility to respond quickly to market turbulences.

Some recent advances in the technology of shale oil include:

- **Horizontal drilling**. Traditional oil wells drill straight down, but since the 1980s many more commercial wells have drilled first down, then round a corner, then out horizontally for another mile or more. The advantage is that this method exposes a much greater area in a layer of oil-bearing rock.
- **Multi-stage hydraulic fracturing.** Hydraulic fracturing, or fracking, uses water, sand and chemicals pumped into a well to open small cracks that will release the oil or gas. It has been used since the 1940s. Refinements to the technology have opened up previously unyielding shales for first gas, then oil.
- **Walking rigs.** The most modern rigs are able to "walk" from hole to hole on stubby legs, making them more flexible and cheaper to move.
- **Proppants.** Sand is used in fracking fluids to "prop" open cracks created in the rock so the oil and gas can flow out. Companies are experimenting with various proppants, such as ceramics, which can give better results.

Sources: Media and Ft.com, April 24, 2015.

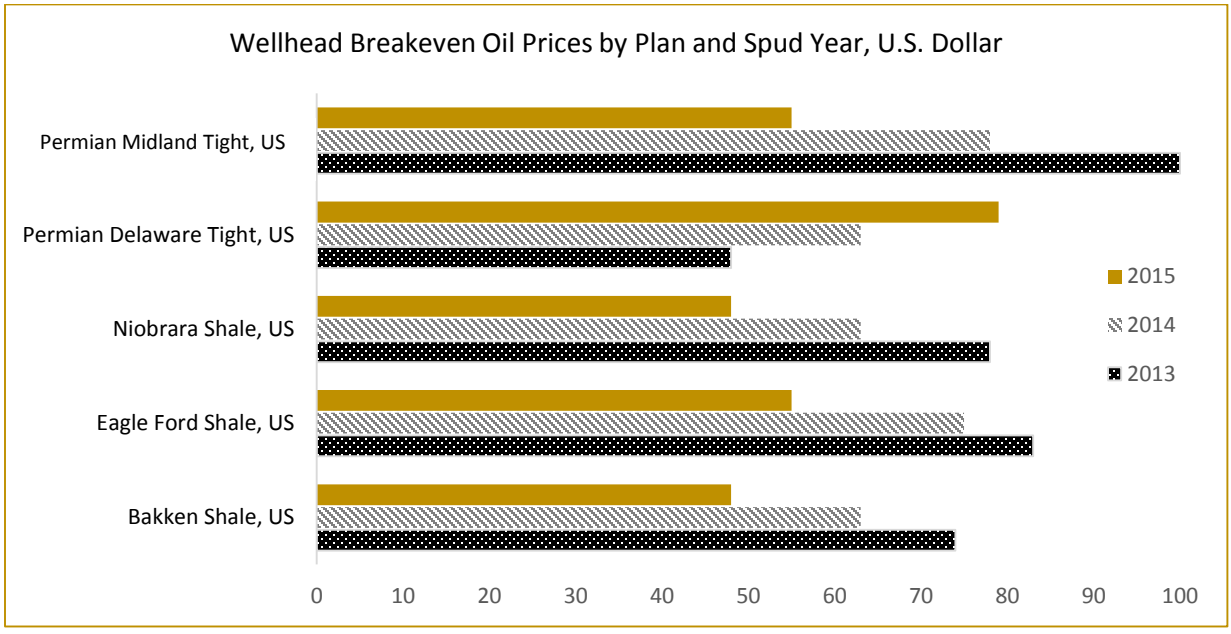
**Table 2. Cost Break-even Oil Price Estimates for the US Shale Oil Industry**

| Region | Date | Source | Estimate |
|---|---|---|---|
| Bakken | 2015Q3 | North Dakota Industrial Commission (NDIC) | $30-$45 |
| Bakken | 2015Q3 | Federal Reserve Bank of Minnesota | $53 |
| Eagle/Permian | 2016Q1 | Bloomberg Intelligence | $23-$59 |
| Multiple regions | 2015Q3 | Federal Reserve Bank of Kansas City | $60 |
| Multiple regions | Recent | Wells Fargo | $25-$46 |
| All regions | Recent | Rystad Energy | $36 |

Source: Board of Governors of the Federal Reserve System, March 2016.

There are several estimates for break-even prices for shale oil companies. Bloomberg New Energy Finance estimates that sustaining current levels of shale oil production would require a return on investment of 10 percent, but increasing production would need a 20 percent return. Using these rates, they look at the oil price required for each region to get such returns. Based on these calculations, the US oil industry will fall off a cliff should the oil price remain below $50 a barrel for more than a year. According to Wood Mackenzie, the largest 50 publicly-traded oil companies would breakeven at $53 p/b.

**Figure 6. Efficiency Gains for the US Shale Oil Industry**




Source: Board of Governors of the Federal Reserve System, March 2016.

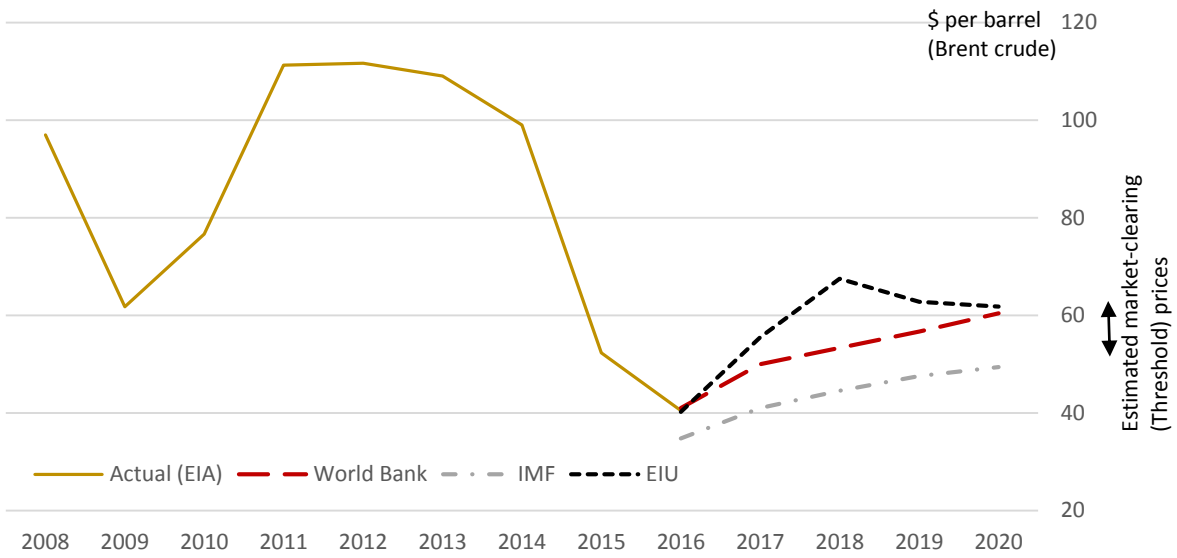
**What is the "New Normal" for Oil Prices?** Forecasts about the trajectory of oil prices are routinely made, but the results are often uncertain and inaccurate, and prediction errors are large. Most of the times, shocks are not predicted at all. For example, the 1986 and the most recent collapse in oil prices in 2014 were not expected by forecasters. Given the uncertainty about oil supply and demand and traders' expectations of market conditions and the fact that series of forecasts for oil prices already exist, we gather estimates from several forecasters, including International Financial Institutions and the futures market. Oil price forecasts by the World Bank, IMF and Economist Intelligence Unit (EIU) are shown in Figure 7, top panel. The latest price forecasts for 2017 (as of April 2016) ranges from $41 (IMF for spot crude) to $60 (EIU for Brent) with the World Bank estimating $50 a barrel. Of course, these are subject to change, as they have been revised significantly over the past several months. To minimize forecasting errors, we calculated a simple average of oil prices forecasted by the World Bank, IMF and EIU for the period of 2016 to 2020. Our estimates show that oil prices are expected to reach $50.3 a barrel in 2017, and increase to $57.1, $59.1, and $60.4 a barrel in 2018 through 2020 respectively.

Oil price forecasts set by the futures market and those estimated by Consensus Economics could also shed light on the direction of oil prices in the short term. Oil futures prices reflect the price both the buyer and the seller agree on upon delivery at a certain time in future, reflecting investors' expectations about the future of oil prices. The trajectory of prices normally include quite large and volatile risk premiums – defined as the difference between the oil futures price and the expected spot price from the Consensus Forecast's survey, but these premiums are close to zero on average (Federal Reserve Bank of San Francisco Economic Letter, 2005). The data show that trading in the futures market for oil delivery in December 2020 is about $58.3 a barrel (Figure 7, bottom panel, right chart). Consensus Economics provides individual and consensus forecasts for crude oil prices (in addition to prices of other commodities) of 25 prominent economic and financial forecasters globally.

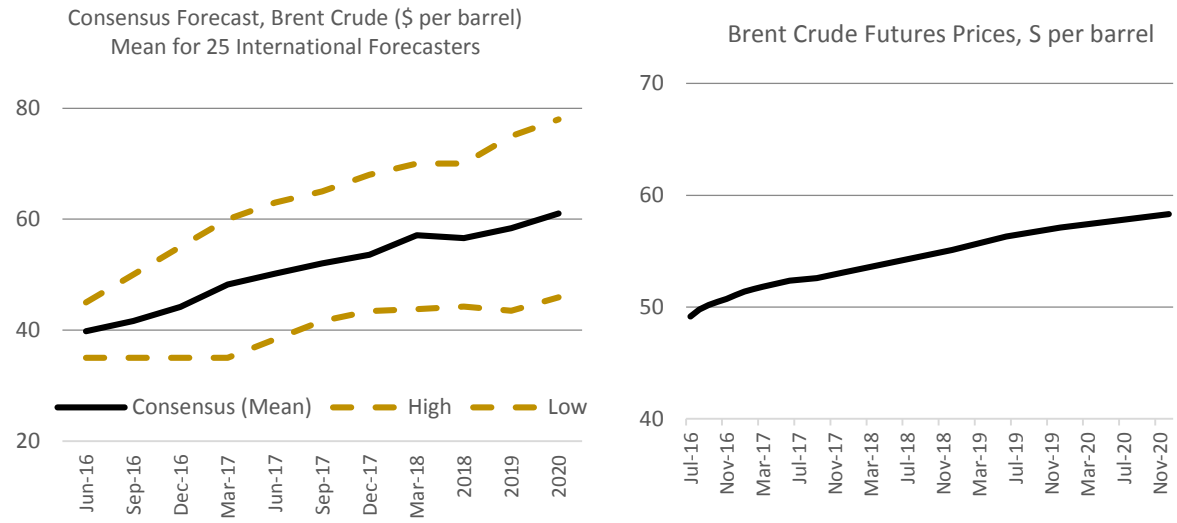
The mean of the oil price forecasts is reported in Figure 7, left bottom panel.[11] Taking into account the trajectory of futures oil prices and consensus forecasts, it appears that the market will not rebalance at least until 2020. When it does so, the market-clearing price will be in the range of $53 to $60 a barrel (see Figure 4). This price range is also feasible with respect to the cost break-even oil prices for shale regions (see Table 2).

[11] Consensus forecasts from Consensus Economics, Inc., summarize estimates for oil prices from 25 prominent economic and financial forecasters' including CIBC, Lloyds Bank, Barclays Capital, Citigroup UBS, TD Economics, Moody's Analytics, Macquarie, Credit Suisse, Investec Econ Intelligence Unit, P K Verleger, Capital Economics, Bank of China International, BNP Paribas, JP Morgan, Australia Department of Industry, Morgan Stanley, Societe Generale, GKI Research, Euromonitor, International Oxford Economics Commonwealth Bank, Banco de Credito del Peru.

**Figure 7. Actual and Forecast Oil Prices**




Sources: World Bank, IMF, US Energy Information Agency (EIA), and Economist Intelligence Unit (EIU). Note: IMF's crude oil forecasts are average of futures prices for U.K. Brent, Dubai and West Texas Intermediate calculated for various contracts and date of forecasts releases. The World Bank oil price forecast are based on spot prices. All forecasts are prior to the Brexit events.




Sources: Consensus Forecast, Energy and Metals, May 2016 and Intercontinental Exchange (ICE) Futures.

Prices around $50 a barrel oil have often been held up as a possible tipping point, a price high enough to induce more drilling. Some wells in Texas and Oklahoma are profitable at $50 a barrel. If oil stays at $50 a barrel, drilling could slowly return, although the new wells drilled will not be enough to stem the decline in overall U.S. oil production. Higher prices will be needed to spark higher output. At $60 a barrel, many more wells will come back to the surface and investment in new wells will pick up.

The timing of re-balancing depends on a steady increase in future demand or a sustained cut in the future supply (or both). On the future demand picture, a key factor is the rise in Non-OECD Asian countries' demand for oil. These countries, including China, are expected to remain the major source of oil demand growth with volumes increasing from 23.7 million b/d in 2015 to 28.9 million b/d in 2020, according to the IEA. China's growth remains central to this, because of the underlying rise of oil demand and its build-up of strategic reserves which will reach at least 500 million barrel by 2020. Platts China Oil Analytics projects that the average annual growth rate of crude imports between 2015 and 2020 will be about 5.5 percent, with 10.5 million Metric Tonnes (M/T) per year, or roughly 210,000 b/d, expected to be imported for stock building.

The supply side of the balance remains the crucial part in assessing when the oil market will re-balance. Growth in oil supply is estimated to outpace demand over the next few years leading to price recovery happening only after 2019. The reason is the huge stock buildup of the past three years - currently standing at 1.2 million b/d in the U.S. and 1.5 million b/d globally - that could dampen the pace of recovery in oil prices in 2016 and 17 and most likely 2018 (see the current market trend in Figure 4). At the same time, a production cut is estimated to come from the high cost oil producers (US shale), who have the capability to respond rapidly to market imbalances. The IEA expects US oil production to fall back by 600,000 b/d in 2016 and by another 200,000 b/d in 2017.

Putting all these together, it appears that the market will most likely rebalance in 2019 or early 2020 when the demand and supply for oil are expected to balance at a market-clearing price. At equilibrium, the market-clearing price will settle close to the marginal cost of the last producer, US shale oil producers. On average, they break even at prices close to $53 to $60 a barrel (see previous section). While the accuracy of these forecasts remains in question, our analysis shows that a market-clearing price could be somewhere between $53 and $60 a barrel by the end of the decade.[12] This is probably the "new normal" oil price that is high enough to ease pressure on some of the oil producers, particularly the US shale oil companies, and low enough to keep them from drilling more.

Our analysis shows that oil prices will more likely settle close to $60 a barrel by 2020. There is a consensus in the US shale oil industry that at oil prices above $60 a barrel, the industry would pick up. In effect, that would put a ceiling on oil prices, because as soon as oil becomes expensive enough, there will be more drilling and more supply coming on the market. Data from Baker Hughes show that at WTI crude oil prices of $60 a barrel, in mid-June of last year, U.S. oil production surged. The sharp reaction of US oil production is correlated with their high operating

[12] The price of crude Brent differs from WTI due to competition between two crudes in the U.S. Gulf Coast refinery market, but the price gap appears to have been closed recently. Crude Brent and WTI were trading at $48.6 and 48.7 on May 24, 2016 respectively.

cost. Drilling costs for shale firms make up to around 40 percent of the total cost to construct and finish oil wells. Once prices begin to pass this threshold, these firms will quickly complete the wells and increase production.

Risks to these projections remain high. Price forecasters revise their estimates frequently and, in some cases, on a quarterly basis (see for example price forecasts by the EIA and the IEA). Shale oil drillers could improve efficiency and increase profitability per barrel of shale oil. They could then break even at lower prices, moving the threshold prices at which the market rebalances to a lower path. The third risk to our oil price projections comes from tackling climate change and replacing fossil fuels with renewable energy that could lower the profitability of fossil fuel extraction. This could impact the demand and supply of oil as producers may find it profitable to extract now rather than wait for the future where demand for oil may fall.

On the supply side, the return of Iran, Libya and Iraq to the oil market could exacerbate the oversupply in the market, pushing prices further down. By contrast, diversifying MENA economies away from oil could lower oil production and help ease the supply glut. Other risks include the U.K.'s surprising vote to leave the European Union (EU) on June 23, 2016 which led to a 5 to 6 percent decline in spot and futures prices. While futures regained their losses in the aftermath of Brexit (on June 29$^{th}$) as the market has been focusing on the oil glut – it may slow down our projections for the timing of market rebalancing (see Box 3). Estimates by PIRA Energy Group based in New York show that the impact of Brexit on global demand will kick in in 2017, slashing 100,000 to 200,000 b/d as a result of slower growth in Europe.

**Box 3. What Brexit Means for Oil Prices and MENA Countries?**

The United Kingdom's June 23, 2016 vote to exit the European Union (Brexit) has been a source of uncertainty for the global economy in an already fragile environment. And if Brexit takes some time, perhaps two years, market uncertainty will not abate any time soon. Increased global risk aversion could potentially set back European and global growth. In a severe financial market disruption scenario, the World Bank estimates that Brexit could potentially reduce global GDP by up to 0.9 percent over a two-year period. Lower growth in the U.K., the broader EU and globally will have significant consequences for the oil market and oil prices in particular. MENA countries are not immune and could be affected through three channels: oil prices, appreciation of U.S. dollar, and trade with Europe including Foreign Direct Investment (FDI), remittances and capital flows. Here we will discuss the impact of Brexit on oil prices in MENA countries.

Oil prices reacted swiftly to the Brexit news on June 24th where spot prices dropped by 5 percent and futures prices by 6 percent. The decline in oil prices was triggered by the expectation of a slowdown in global growth and in particular in the UK, Europe and possibly emerging economies such as China. While the market rebounded a few days later, there is a possibility that Brexit would deteriorate the already weak demand for oil and push prices further down. Estimates show that if the slowdown remains within the U.K., the impact on oil prices will be limited. This is because the U.K. imports about 1.6 million b/d of oil, or 1.6 percent of the global total. However, if the slowdown spreads to the rest of the EU, the impact on oil prices could be serious, since EU countries consume close to 11.1 million b/d, about the same as China's consumption.

The second important short-term impact will be the appreciation of the U.S. dollar, brought on by increased demand for U.S. Treasury Bills as investors seek safe assets. A number of MENA countries, including all the GCC except Kuwait, have their currency pegged to the dollar, and so will experience a decline in the competitiveness of their exports, at a time when they are trying to diversify their export base. These countries will also be affected through the second-round effect. An appreciation of U.S. dollar could inversely affect oil prices, pushing them further down and delaying the recovery in oil prices (see section on Market-clearing "Threshold" Oil Prices).

In short, oil prices, which had gradually climbed to above $50 a barrel recently, could slide again, due to reduced energy demand, a rising U.S. dollar as investors seek a safe haven, and the declining pound and euro. Iraq, Iran, Saudi Arabia, other Gulf monarchies and the rest of MENA oil producers will feel the renewed pinch brought on by Brexit in the short term. MENA oil importers will feel the pain through lower remittances, FDI, tourism receipts, aid and mostly through the slowdown in GCC countries.

## Could the New Normal for Oil Prices Change the Old Social Contract in MENA?

MENA oil producers have been grappling with low oil prices for the past few years. Oil revenues have been falling for the third year in a row with fiscal deficits and debts rising. It has also came at a time when several of them--Libya, Iraq, Syria and Yemen--are dealing with the devastating impact of civil war and forced displacement crises, exacerbating pressure on their already tight budgets.

These countries are well known for their pro-cyclical policies, especially their spending during oil booms, and this has shaped the trajectory of their economic growth. Historically, oil wealth has been used to support the existing social contract between the state and citizens where the former provided fuel and food subsidies, free health and education, handouts and public sector jobs in return for muted citizen voice and limited accountability.

This time seems to be different. With low oil prices staying long, governments in the region are not only taking austerity measures seriously, but they are introducing some bold measures that are expected to transform at least part of the old social contract. These reforms include reducing the bloated public sector wage bill, privatizing State Owned Enterprises (SOEs), and diversifying their fiscal revenues away from oil through increasing direct and indirect taxes. The group of GCC countries is preparing to introduce Value Added Taxes (VAT) for the first time.

In this section, we discuss how MENA's major oil producers [13] are responding to the oil price crash as a way of examining how the social contract may be changing.

**How is MENA Reacting to the Oil Price Crash?** Oil accounts for a significant part of MENA oil producers' exports earnings (Figure 8). Iraq, Libya, Algeria and Kuwait rely totally on oil. The rest of the oil exporters' dependency is less, but still significant. Persistently low oil prices continue to damage their finances, eroding trade balances, slowing growth and increasing pressure on their currencies. Estimates show that fiscal balances in MENA oil exporters swung from a $128 billion surplus in 2013 to a deficit of $264 billion in 2016 (Table 3). The group of Gulf Cooperation Council (GCC) countries lost $157 billion in oil revenues last year and is expected to lose another $100 billion this year. As a result of the pro-cyclical spending in the past, the fiscal break-even oil prices have increased substantially compared to the average of 2000-12. In 2015, Libya ($196.9) followed by Algeria ($109.8), Bahrain ($107.2), Iraq ($100.5) and Saudi Arabia ($105.6) had the highest break-even oil prices, among others. Some of these countries' reserves will come under pressure because of the drain on the budget. Fiscal deficits in Libya, Saudi Arabia, and Algeria have been estimated at 75.3, 18.9, and 15.7 percent of GDP in 2015 respectively.

[13] MENA oil exporters include: GCC (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and United Arab Emirates), Algeria, Iran, Iraq, Libya, and Yemen. Syria is excluded due to lack of data.

**Table 3. Economic Growth and Fiscal Outlook**

| | Real GDP Growth, percent | | | | | | Fiscal Balance as percentage of GDP | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2013 | 2014 | 2015e | 2016f | 2017f | 2018f | 2013 | 2014 | 2015e | 2016f | 2017f | 2018f |
| MENA | 2.0 | 2.4 | 2.3 | 3.1 | 4.2 | 3.9 | 2.2 | -2.1 | -10.2 | -9.9 | -7.1 | -4.2 |
| Oil Exporters | 1.9 | 2.3 | 2.0 | 3.2 | 4.2 | 3.8 | 5.7 | -0.2 | -11.3 | -11.1 | -7.3 | -4.3 |
| GCC countries | 3.3 | 3.4 | 3.1 | 2.0 | 2.5 | 3.1 | 10.9 | 3.5 | -10.9 | -10.4 | -7.5 | -4.5 |

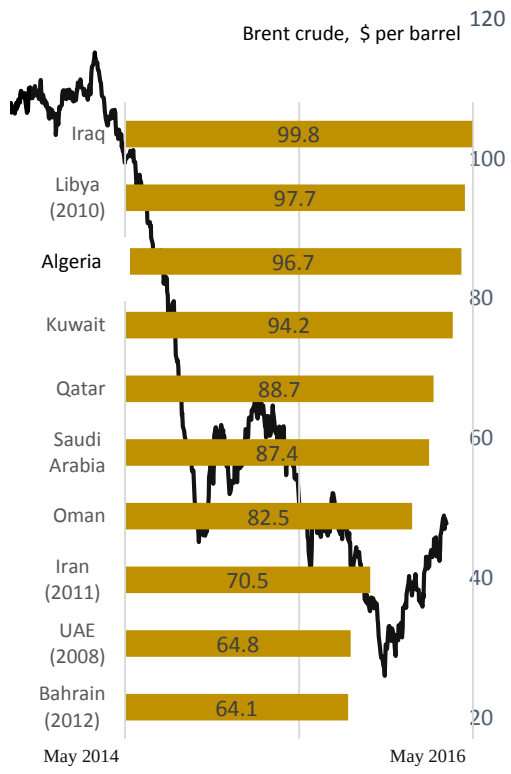
Source: World Bank. Note: MENA includes: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, UAE (GCC group of countries), Libya, Yemen, Algeria, Iran, Iraq, Syria (Oil exporters), Egypt, Tunisia, Djibouti, Jordan, Lebanon, Morocco, and West Bank & Gaza (Oil importers), f and e stand for forecast and estimate.

Several of them have been using their reserve cushion and international capital markets to issue debts.

Estimates show that Saudi Arabia has exhausted $178 billion in reserves, followed by Algeria ($28 billion), and Iraq ($27 billion) in 2015. In April, Saudi Arabia raised $10 billion from a consortium of global banks and aims to raise another $15 billion in loans to finance its deficit of about 16.3 percent of GDP in 2016. Iraq is relying on external and domestic financing of its deficit of about 14.5 percent of GDP in 2016 and its debt is estimated to double in 2016 from 27 percent of GDP in 2014. In a scenario where the oil market rebalances at an average price of $60 a barrel over the next few years (see previous section), these countries will need to prepare for the post-oil era.

**GCC Countries.** The GCC countries have been using their reserves, turning to debt markets, and cutting spending to deal with cheap oil. But more actions are needed since, as discussed earlier, oil

**Figure 8. Oil Exports % of Merchandise Exports, 2013 and Oil Prices**




Sources: World Bank and IMF.

prices will be low for some time. Some of these countries have been taking tough measures or planning to reform the public sector which could ultimately change their economies. These measures include cutting public sector jobs and salaries, privatizing SOEs and more importantly, introducing income and indirect taxes (VAT).

**Bahrain.** Bahrain is one of the vulnerable countries in this group due to its limited savings, low reserves and high debt levels. Despite plans to curb spending, Bahrain is expected to continue to run significant fiscal deficits over the next few years, currently estimated at 16.8 percent of GDP in 2016. Consequently, government debt is forecast to increase from 44 percent of GDP in 2014 to 83.7 percent in 2016, placing Bahrain in breach of the 60 percent debt-to-GDP stability criterion, required by the future GCC currency union. The fiscal break-even price for Bahrain is estimated at $107.2 p/b in 2015, the highest among GCC countries. Given the existing sectarian tensions and the government's plans to cut subsidies, the country remains vulnerable to civil unrest as well as regional tensions. Tourism and financial services activity could dampen as a result of the slowdown in the region. The current account will record a deficit of 8.2 percent of GDP in 2016. Reserves are expected to decline to 4.3 months of imports in 2016 from 5.8 in 2014.

In response to lower oil revenues and the subsequent growth slowdown, Bahrain began taking significant fiscal consolidation measures in 2015 and is now seeking a higher cap on the public debt ceiling. Revenue-enhancing measures include increasing tobacco and alcohol taxes and increasing fees on some government services (primary health care). A cost-cutting program entailed the removal of the meat subsidy in 2015 and raising petrol prices by 60 percent in January 2016 (which is likely to create savings worth $148.4 million); the gradual phasing-in of price increases for electricity, water, diesel and kerosene by 2019; and an increase and unification of natural gas prices for industrial users at $2.5 per million BTUs beginning April 2015. As a result, the 2015 non-oil primary balance improved by 2.5 percent of non-oil GDP relative to 2014. However, this was insufficient to mitigate the negative impact of lower oil revenues. Rationalization of government expenditures is also planned in the near-term. Lower oil prices are forcing the government to cut back on the capital budget as restraining current spending may exacerbate the already tense political scene. Members of parliament have also proposed a law to fully privatize several state-owned businesses to help curb the deficit.

**Kuwait.** The country relies on oil for more than 50 percent of its GDP and 93.6 percent of fiscal revenues. It currently owns one of the largest foreign assets (including a Sovereign Wealth Fund, SWF) among GCC countries, estimated at $600 billion. On the back of its large fiscal surpluses (Kuwait had the largest fiscal surplus in the GCC prior to 2014), substantial reserves and periods of high oil prices, government spending rose from 38.8 percent of GDP in 2013 to 50.1 and 60.8 percent of GDP in 2014 and 2015 respectively. Fiscal balances, however, swung from a surplus of over 35 percent of GDP in 2013 into a deficit of 3.6 percent of GDP in 2015. The

magnitude of the drop in oil revenues amounted to $15 billion each year in 2014-15. Kuwait's first response to low oil prices was to draw down on its foreign assets. Spending cuts were not proposed until recently, and they are negligible; the draft 2016/17 budget indicates only a 1.5 percent pullback in government expenditures. One of the areas of cuts in spending is subsidies where a smaller amount for petroleum and gas subsidies is allocated in its 2016/2017 budget than previous years, amounting to KD 238 million ($791.4 million) for petrol and gas products this year. Last year, diesel and kerosene prices were tripled (yielding fiscal savings of 0.3 percent of GDP), only to be partly reversed later. On a longer term view, a medium-term (five-year) economic reform agenda was recently approved by the Government. The reform agenda focuses on public financial management, privatization, PPPs, SMEs, investment reform, civil service and labor market reforms – and if implemented as a package could help begin the process of rebalancing the Kuwaiti economy away from oil (see next section).

**Oman.** With production of less than 1 million b/d of oil, the Sultanate of Oman has less oil and gas reserves compared to its GCC neighbors, except Bahrain. Since the sharp drop in oil prices in the second half of 2014, the government has taken bold steps to increase revenues from non-oil sources. These include turning to debt markets for the first time (it sold $2.5 billion in bonds on June 8) and taking on some reforms such as subsidy cuts, reduced benefits for public sector workers and increased fees. Furthermore, they introduced a royalty on telecom operators, a "fair tax" on Liquefied Natural Gas (LNG) exports, and an increase in royalties paid for mineral exploitation. Oman has recently approved a 35 percent tax on petrochemical firms and increased taxation on liquefied natural gas companies. The change will see taxes on LNG firms increase from 15 to 55 per cent. Reforms in 2015 include the doubling of the price of gas for industrial users. The World Bank estimates that $10 billion in revenues were lost in 2015, and the new budget projects a deficit of 16.8 percent of GDP in 2016.

Government subsidy spending is expected to fall by 64 percent in 2016, as local fuel prices are brought in line with global prices. The deregulation of petrol prices began in mid-January 2016, with diesel and petrol prices increasing by up to 33 percent. An increase in the corporate income tax rate from 12 to 15 percent, as well as the removal of the tax exemption for the first OMR 30,000 of taxable earnings, has been approved by the Shura Council and a GCC-wide VAT has been agreed upon. Other measures to boost non-hydrocarbon revenue include: revising electricity and water tariffs for commercial and industrial users; and increasing fees for government services including licenses and labor cards, vehicle registration, real-estate transactions and land allocation.

**Qatar.** As part of the plan to counter the impact of the oil price shock to its economy, the government of Qatar was restructured in January 2016. Austerity measures are already being taken to counter the wasteful spending, overstaffing and lack of accountability. Following years

of surpluses, Qatar is estimated to run a budget deficit of $8 billion, equivalent to 5 percent of GDP in 2016 —the smallest among the GCC countries. Yet, given that the budget planners in Doha calculated oil at $48, Qatar's deficit may actually increase. Other signs of cheap oil harming the economy was the growing cost of Qatar Petroleum (QP) and Royal Dutch Shell, which led to the latter's pulling out of the $6.4 billion al-Karaana petrochemicals project. The QP also laid off about 1,000 employees.

To finance budget shortfalls, Doha officials have recently implemented measures such as hiking utility rates, doubling fines for wasting water, and increasing the cost of Qatar's postal services for the first time in eight years. On January 14, 2016, Qatar's state-owned fuel company, Woqod, announced a 30 percent hike in gas prices, causing a liter of unleaded gas to reach $0.36. The subsidy cut went into effect only hours after the announcement. The last time Qatar raised gas prices was in 2011. Woqod's price rise in January came on the heels of Bahrain, Oman and Saudi Arabia also cutting gas subsidies. With more austerity to come, Qataris are expecting cuts in electricity subsidies later this year. New cuts and price increases will likely fall hardest on expatriates.

Qatar also ordered state-owned institutions such as Qatar Museums and Al Jazeera to reduce their programming and/or lay off expatriates. Officials slashed the Qatar Foundation budget by 40 percent and made significant cuts at Western academic institutions in Education City. Last December, Sidra Medical and Research Centre cut hundreds of jobs and officials have put the brakes on plans to roll out a national health care scheme. The Qatari Tarsheed initiative penalizes households for lighting buildings at night.

**Saudi Arabia.** The 2014 price crash together with the high spending of the last several years have been draining the government budget. Oil accounts for more than 80 percent of government revenues and with currently low oil prices, fiscal deficits are expected to surpass an estimated $118 billion in 2016 (about 16 percent of GDP) and $97 billion in 2017.[14] International reserves are down by 20 percent (standing at $587 billion as of March 2016); at this rate, reserves will be wiped out in four years. The Kingdom has borrowed significantly including $26 billion last year and a $10 billion loan finalized in April of this year; they are planning to raise another $15 billion through issuing bonds. This will put the ratio of debt to GDP to 26 percent in 2017 from low levels in 2014. The cost of borrowing has risen, following a lowering of Saudi Arabia's credit rating by rating agencies. Estimates by the IMF show that an oil price of $105.60 is needed to balance the budget, which is more than twice current levels.

The government has taken austerity measures in the 2016 budget including a 14 percent cut in spending mostly on defense and fuel subsidies and an increase in oil revenues by producing more

[14] In the previous oil slumps, the deficit was $23 billion in 2009 and $13 billion in 1998.

oil.[15] In addition, budgetary allocations for health, education and municipality services have been reduced. The largest increases in fuel prices are 133 percent for ethane, 79 percent for transport diesel, and 67 percent each for natural gas and low-grade gasoline. Prices of electricity and water have also been raised by up to 60 percent for higher tiers of residential consumption and by varying amounts for commercial and industrial users. The wage bill is reduced to less than 15 percent of GDP, curtailing public-sector wage increases and renegotiating all contracts, alongside cuts in capital expenditure. The overall effects of these measures are contractionary, lowering real GDP growth to a projected rate of 1.9 percent in 2016 from 3.5 percent in 2015. Prior to the oil crash, the economy grew by an average of 5 percent per annum.

To emerge from the era of low oil prices, the Saudi government has approved a comprehensive reform program articulated in the National Transformation Plan (NTP) - "Vision 2030" - which aims at diversifying the economy away from oil, within 15 years. The plan envisages the leveraging of assets of the state-owned oil company (ARAMCO) to fund wide-ranging public investments. The vision had been planned with a price of $30 a barrel and focuses on three major areas. First, it seeks to triple non-oil revenues by the end of the decade through levying indirect taxes and fees on public services including the introduction of a VAT and developing non-oil sectors like mining, tourism and education. Second, it will lower public spending by reducing subsidies, diverting spending on arms away from foreign partners and rationalizing public investment. Coupled with reducing the public wage bill by 5 percent, these reforms could amount to $53 billion in added revenues by 2020. Third, the plan aims at diversifying the national wealth and diversifying the investment portfolio abroad. Of importance is privatizing part of the State-owned oil company Aramco, through an Initial Public Offering (IPO) - which produces 90 percent of government's revenues - to raise funds.

**United Arab Emirates (UAE).** The Emirate produces about 3 million b/d of crude oil, but government revenues have been falling continuously from 41 percent of GDP in 2013 to about 29 percent of GDP in 2015. In an environment of low oil prices, the government has continued its spending trend with expenditures rising from 30 percent of GDP in 2013 to 34 percent of GDP in 2015. As a result, the surplus of about 10.4 percent of GDP in 2013 has turned into a fiscal deficit of an estimated 5.2 percent of GDP in 2016. The high real GDP growth of over 6 percent per year in recent decades is starting to fall off due to lower oil revenues. The government has been investing its oil surpluses into the non-oil economy. In particular, it has managed to develop the Dubai financial and real-estate centers, international airline hubs in Dubai and Abu Dhabi, and sports-tourism in a number of Emirates as well as light manufacturing and transport and retail trade services. However, since June 2014, it has been affected by plummeting global oil prices which have resulted in a drop in hydrocarbon exports and revenues. While it managed to

[15] Oil output has risen from 9.7 million b/d in 2014 to an estimated 10.1 million b/d in 2015 and 2016, and 10.3 million b/d in 2017.

sustain growth rates of 4.6 percent in 2014 and an estimated 3.3 percent in 2015, UAE's growth in 2016 is projected to drop to 2.1 percent.

Though reserves stand at comfortable levels to cushion the impact of low oil prices, the UAE government is keen to raise non-oil revenues by implementing a VAT at the latest by 2018, in conjunction with other members of the Gulf Cooperation Council. It is also considering the introduction of a corporate tax. However, additional measures will be needed including a reduction in electricity and water subsidies and a gradual slowdown in the implementation of Government Related Entities (GRE's) mega-projects.

**Other Oil Exporters**

**Algeria.** Algeria exports 540,000 b/d of its total production of about 1.1 million b/d. However, crude oil and natural gas production have gradually declined in recent years, mainly because of repeated project delays, difficulties in attracting investment partners, infrastructure gaps, and technical problems. The economy is heavily reliant on hydrocarbons for its exports and government revenues, standing at 95 and 75 percent respectively. The oil price crash has eroded its finances, trade balance and international reserves. Fiscal deficits have been rising from 1.4 percent of GDP in 2013 to 15.7 percent of GDP in 2016. Total reserves have fallen from $194 billion in 2013 to an estimated $108 billion in 2016 and are projected to decline further to $60 billion in 2018. The deterioration of Algeria's terms of trade led to a 20 percent nominal depreciation of the dinar since mid-2014; inflation picked up to 4.8 percent in 2015.

Facing a constant decline in oil and gas revenues and high import bills, the government has adopted a set of corrective measures as part of the 2016 budget law. Formulated under the assumption of an average oil price of $35 p/b, the 2016 budget calls for a 9 percent cut in expenditures—mostly in capital expenditure—and a 4 percent increase in tax revenues. The set of revenue measures includes a 36 percent hike in fuel prices, higher VAT rates on fuel and power consumption, and higher taxes on car registration. Further adjustments to power tariffs and new import licenses have been announced but details are still pending. These measures are first steps toward a possible comprehensive reform of Algeria's costly and regressive subsidies (Fuel and other subsidies represent more than 12 percent of GDP). The budget also allows the government to adopt additional corrective measures if oil prices were to fall below $35 p/b and to engage in external borrowing. These include new import licenses, raising electricity prices closer to their cost, and further depreciation of the currency. The government has attempted to open up public companies to private investment. The 2016 budget includes measures to allow for private investment in state-owned enterprises, creating new industrial zones, and easing restrictions on the investment of revenues accrued from tax breaks. A new investment law was passed by the parliament in July aimed at improving the business sector outside of the oil industry.

**Iran.** The slump in oil prices has hurt the Iranian economy but by less than other oil producers in the region. The reason is that compared to other oil producers, the Iranian economy is more diversified, and therefore less dependent on oil revenues. Oil accounts for about 30 percent of government revenues. To maintain market share, Iran's oil production has increased since January 16, 2016 when implementation of the Joint Comprehensive Plan of Action (JCPOA) and lifting of sanctions began. Some 600,000 b/d has been added so far and the government plans to raise it up to 800,000 b/d by the summer of 2016, reaching pre-sanction levels (prior to 2014). As part of the JCPOA, some $30 billion of frozen assets have been released, allowing the government to access funds and assets abroad. The government has taken some actions to mitigate the impact of low oil prices on its budget including raising taxes on parastatal organizations which were previously exempt.

**Iraq.** Falling oil prices and civil war have increased the risk of political and fiscal instability in the country. Despite a large increase in oil production from 3.1 million b/d in 2014 to 4.3 million b/d on average in 2016 and in exports to about 3.8 million b/d in 2016 from both Basra and the Kurdish region, finances keep worsening due to the government's pro-cyclical policy of over spending during the oil boom years, in addition to the cost of war and conflict. Oil constitutes over 90 percent of government's revenues and with prices falling from their peak of $147, the budget deficit is estimated above $30 billion in 2016.

To cope with the effects of reduced oil revenues, the government cut public spending by 40 percent last year - mostly capital spending - and canceled some military contracts. The cut to public investment will affect the pace of reconstruction in areas recaptured from Daesh, and could result in worsening of sectarian tensions given that the destruction is almost entirely taking place in Sunni areas. The government has also dipped into its foreign reserves, which are expected to fall to about $43.9 billion in 2016 and $36 billion in 2017 from $66.7 billion two years ago. As a result, the Iraqi Dinar was devalued slightly by 1.37 percent against the U.S. Dollar. If oil prices stay low, further devaluation of the currency may be needed.

The Kurdistan Regional Government (KRG) authorities have responded by cutting government salaries as much as 75 percent for high-ranking officials and seizing funds from local branches of the Iraqi central bank. Given the sharp drop in oil revenues in the amount of $46 billion in 2015, new measures were adopted to increase public revenues including the introduction of sales taxes.

**Libya.** The country is struggling with civil war, two governments (the Tripoli-based government (General National Congress (GNC)) and the Tobruk-based government (Elected parliament), insurgencies in oil fields, and low oil prices. Libya relies on oil for 98 percent of its exports and fiscal revenues (Figure 8). The Tripoli-based government produced 500,000 barrels of oil a day in 2015 and exported almost 450,000 b/d. Two separate budgets were approved in 2015: the Tripoli

based government approved a budget of about 42.9 billion LYD with exports of half a million b/d of oil (more than half of its exports in 2012) with a price of $50 a barrel. Public sector wages and salaries and food and fuel subsidies constitute more than half of the spending in the budget. As the pressure from low oil prices kicked in, the GNC decided to reform the huge food and fuel subsidies, replacing them with monthly cash transfers in the amount of 50 Dinars ($36.5) for each citizen. But the idea was rejected by the Parliament.

In response to low oil prices, some austerity measures have been taken, but at the same time the government is rewarding public employees in the education sector with 300 Dinars ($219) in extra pay. Public sector wages and salaries, and subsidies account for half of the government's expenses. The fiscal deficit has reached a record high, estimated at 60 percent of GDP in 2016. The Tripoli government has resorted to the Central Bank's reserves which have been falling to $70 billion in 2016 from $120 billion in 2012. If the trend continues, Libya will run out of reserves in less than 4 years. The rival government in Tobruk resorted to borrowing from the Central Bank. The Libyan Dinar is under significant pressure from low export revenues due to cheap oil and lower oil production and the international sanctions on exportation of dollar currency to Libya since 2013. The Libyan Dinar is traded at the black market rate for almost three times the official rate at the Central Bank.

**Yemen.** The country suffers from a catastrophic humanitarian crisis resulting from war, conflict and low oil prices. Oil is the main source of the government budget, accounting for more than 60 percent of fiscal revenues. As a result of war, sabotage on oil fields and falling oil prices, oil revenues fell to 3 percent of GDP in 2015 from 13 percent of GDP in 2013, a drop of $4 billion in a country with a GDP of about $38 billion. The fiscal deficit has widened to 11.4 percent of GDP in 2015 from 4 percent of GDP a year earlier. The government is financing the deficit by issuing debt which has led to a large increase in total public debt from $22.1 billion in 2014 to 25.9 billion in 2015, reaching 94 percent of GDP. The 2015 loss in foreign financing and in oil and gas exports increased pressures on the Central Bank's foreign assets, which declined from $5.3 billion (5 months of imports) in 2013 to $2.1 billion (about 1.5 months of imports), a level that is not sustainable.

In response to low oil prices, the government has reduced spending and suspended the public investment program and cash assistance to the poor, and cut the premium on wages. It has also reduced spending on basic social services, such as education, health, water and electricity, resulting in a complete suspension of diesel and fuel oil-powered stations. Falling oil prices have also given rise to a black market where the currency has lost more than one quarter of its value so far. As a result of all of these, the number of poor has been rising, exceeding more than 85 percent of the population.

**Diversification in the GCC.**[16] In the wake of the sharp fall in oil prices, all GCC countries have recently announced plans to diversify their economies and have tailored their privatization to coincide with parallel institutional and legal reforms. Steps taken include attracting Public Private Partnerships (PPPs) and finding innovative ways to address energy security through INDC climate change agenda[17]. Saudi Arabia, for example, has an ambitious plan to diversify its economy away from oil through implementing PPPs and addressing climate change concerns.

**Public Private Partnerships (PPPs).** All GCC countries have recently announced plans to step up their public-private partnership and privatization programs. While motivated in part by fiscal considerations, these announcements should be viewed in the context of a broader, long-standing, reform agenda since many of the countries have historically included public-private partnerships as a key part of their efforts to liberalize and diversify their economies and have tailored their privatization plans to coincide with parallel institutional and legal reforms. However, implementation has often moved slowly, particularly in GCC countries where supporting institutional frameworks have sometimes been lacking, and where privatization programs have often focused on already-successful enterprises.

The Saudi Vision 2030 (National Transformation Plan) budgets 300 million riyals over 5 years to create a “center of excellence” to support the privatization of state-owned companies. The plan listed spending targets for hundreds of initiatives aimed at boosting both economic and social goals, including 4.7 billion riyals on improving hospital emergency rooms and intensive care units. Other spending included 2.1 billion riyals to restructure the postal sector, 5 million to set up an intellectual property authority, 8 million to improve civil service performance and 3.5 billion to maintain cultural heritage. The plan also revealed the government’s intentions to accelerate privatization. For instance, it indicated that the Energy Ministry is planning to transfer all its power generation to "strategic partners" by 2020. Plans for privatizing water desalination were also announced. The aim is to install 3.5 gigawatts of renewable power capacity by 2020 and spend 300 million riyals on identifying locations for atomic electricity plants and preparing them for construction. In the NTP, the country plans to produce 4 percent of its power from renewable energy by 2020 and the Mining sector is to contribute 97 billion riyals to economic output from 64 billion riyals currently.

[16] This section is based on the background note prepared by Maria Vagliasindi, MNA Strategic Cooperation Department, World Bank.

[17] Countries across the globe committed to create a new international climate agreement by the conclusion of the U.N. Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) in Paris in December 2015. In preparation, countries have agreed to publicly outline what post-2020 climate actions they intend to take under a new international agreement, known as their Intended Nationally Determined Contributions (INDCs). The INDCs will largely determine whether the world achieves an ambitious 2015 agreement and is put on a path toward a low-carbon, climate-resilient future.

Projects in Kuwait are at various stages in Transportation, Real Estate Development; Power; Health; Education; Water & Wastewater Management; and Solid Waste Management. Projects in Oman could be in the wastewater, energy, health, transport, tourism and housing sectors, according to preliminary available information. PPP announcements have been done in the tourism and mining sector.

Oman is planning an OMR 500 million (equivalent to $1.3 billion) waterfront development around Port Sultan Qaboos in the capital Muscat. The project is the first announced following the publication of the sultanate's five-year plan. Financing will be arranged through pension funds and private sector investment, with no government cash involved. Private participation in ports is considerable but institutional arrangements at each port vary and can be substantially improved. The PPP focus in terms of capacity building in Qatar is expected in the education and health sectors which are the line ministries with no previous experience in this domain. Qatar's previous experience with PPPs (e.g. through regulation by contract) were designed by the Qatar General Electricity and Water Corporation (Kahramaa).

**Intended Nationally Determined Contributions (INDC) Plans.** All GCC countries recently submitted INDC plans. With the notable exception of Saudi Arabia and Oman, the other GCC INDC do not provide an economy-wide greenhouse gas (GHG) emissions reductions target expressed in terms of reductions below a base year, or business-as-usual levels. Saudi Arabia submitted its INDC, seeking to reduce its emissions annually by up to 130 MtCO2e in 2030 through measures that have co-benefits in pursuing economic diversification from oil while contributing to greenhouse gas abatement and adaptation to climate change. Achievement of this goal is not conditional on international financial support, but is contingent on the continuation of economic growth, and "a robust contribution from oil export revenues to the national economy." Saudi Arabia has not stated the baseline from which its abatement target would be deducted, but specifies that a "dynamic baseline will be developed on a basis of a combination of two scenarios," which are scenarios based on whether more oil is consumed locally, or exported. Oman is seeking to limit GHG emissions growth within 2 percent to be 88.714 MtCO2e between 2020 and 2030, a target conditional on the assistance provided by the UNFCCC on finance, capacity building and transfer of technology.

**Climate Change Mitigation.** On the mitigation agenda, one of the key policies, energy subsidy removal, is included only by UAE and Kuwait, the latter only limited to gasoline. Not surprisingly, UAE is the GCC pioneering country to have implemented subsidy reforms, recognizing in the context of the INDC the value of energy and water tariff reform in reducing inefficiencies and promoting low-carbon development, as well as addressing energy security concerns. Since the submission of the INDC, all GCC countries have implemented further energy subsidies, including in the second quarter of 2016.

Energy efficiency is one of key policies included across the board in GCC INDCs. On the demand side, the UAE highlights the relevance of district cooling as air-conditioning accounts for a significant share of energy consumption. They report comprehensive infrastructure investments to move towards district cooling and improve efficiency as compared to decentralized cooling. In terms of appliance efficiency standards, the UAE introduced the region's first efficiency standards for air-conditioning units, eliminating the lowest performing 20 percent of units on the market, and is introducing efficiency standards for refrigeration and other appliances. The UAE has also established an indoor lighting standard that introduces energy efficient lighting products and phases-out inefficient lighting products in the UAE market. The Saudi program reports its focus on three main sectors, namely industry, building and transportation that collectively account for over 90 percent of the energy demand in the Kingdom.

Bahrain's Energy Efficiency Program (KEEP) targets public, residential and commercial buildings and the industrial sector. It aims to improve energy efficiency to reduce cumulative electricity consumption by 2030. The Energy Efficient Lighting Initiative project supports replacing energy inefficient ILs with efficient CFLs in the short term and with more efficient technologies such as LED based lamps in the medium term in Bahrain. Oman also includes the increase in energy efficiency projects among industries and reduction of HCFC use in the foam and refrigeration sectors. Electricity efficiency in building is also highlighted in the Kuwaiti INDC and a general reference is made in the case of Oman.

**Climate Change Adaptation.** Because of the extreme water scarcity, water is the sector that appears most predominantly across adaptation actions. The UAE is in the process of establishing a strategic federal framework for the sustainable management of all water resources in the country. The strategy is based on an integrated approach that aims to meet future water demand through a mix of new water infrastructure and improving the efficiency of existing water supplies. The UAE is moving towards more efficient forms of desalination, and is investing in research and development of new technologies, including renewable energy to power desalination plants. The use of efficient water production systems such as the reverse osmosis system, campaigns to raise public awareness of rationalizing the use of water, utilizing modern technology to ensure optimal use of water domestically, and in other agricultural and industrial purposes is presented by Kuwait.

Saudi Arabia plans to develop and implement plans that will harness new sources of freshwater, construct additional dams for collection of drinking water and recharging of aquifers. Water saving, recycling, capture, irrigation and sustainable management for agriculture purposes are also presented. Qatar reports significant research and development activities aimed at developing innovative desalination technologies and utilizing renewable energy for desalination and water treatment. Bahrain is formulating a climate-resilient and integrated strategy in order to sustainably manage its water resources. Water security goes hand in hand with food security.

Projects aimed at increasing the ratio of self-sufficiency are reported in Kuwait and Oman. The UAE welcomes and encourages food security research and development, such as modelling to assess the impact of climate change on the agricultural productivity of the major food exporting countries on which the UAE currently relies, and incentivizing technology to increase productivity and resilience.

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