



Development and Industrialization in the Arabian Gulf Region

The Crux of the Gulf Energy Challenge



Justin Dargin

University of Oxford

2013

HARVARD JOURNAL OF MIDDLE EAST POLITICS AND POLICY

Contents

Abstract.....	1
1.0 Introduction	2
2.0 Gulf Economic Transformation	7
3.0 Threats to Diversification: A Focus Upon the Gulf Petrochemical Industry	11
4.0 Conclusion: Implementation of Natural Gas Pricing Reform.....	14
Box One: Case Study: Price Reform in Oman	16

Abstract

The Arabian Gulf region has the most prodigious energy reserves in the world. However, the region's massive industrialization and expanding demography are also increasing energy consumption at unsustainable rates leading to natural gas deficits across the region.

This article argues that the pressures of economic development and industrial diversification are steadily eroding the comparative advantage that the Gulf countries enjoyed for much of the late twentieth century and early twenty-first century that allowed them to support domestic industries with extremely low-cost associated natural gas. As a result, the investment logic that guided energy intensive industries to the region will have to concomitantly evolve.

Due to the region's natural gas shortages, the Gulf governments will begin to reconfigure the dominant pricing framework. Furthermore, the region will begin to transition away from dependence on the current ethane-based petrochemical expansion strategy to one that leverages other feedstocks. Increasing competition from other natural gas production centers (such as China, the US and Australia) will also decrease the competitiveness of the Gulf petrochemical industry. Nonetheless, despite the pressures of the foregoing, this article illustrates that the regional response to such challenges will be the creation of a much more sustainable regional energy and petrochemical sector for the long-term.

1.0 Introduction

The Arabian Gulf region has the most prodigious energy reserves in the world. As of 2012, it contained 486.8 billion barrels of proven oil reserves, approximately 37.5 percent of global supply, with the Kingdom of Saudi Arabia holding the lion's share, at 20 percent of the global total.¹ The latest figures for 2012 indicate that the region collectively produced 17.3 million barrels per day (b/d). With the advantage of enormous oil reserves and small, albeit growing, populations, the region exports the majority of its oil production (BP 2011, 6-18). The region holds approximately 42 trillion cubic meters (TCM) of natural gas, about 23 percent of global natural gas reserves, but it only produces about 8 percent of the total global production. It is estimated that at current production rates, the current proven oil reserves will last another 70 years and natural gas reserves for another 118 years (Arab News 2012).

However, as will be discussed below, there are several structural forces that could blunt the region's immense energy reserves and thereby degrade its ability to foster economic growth. This article argues that the pressures of economic development and diversification are steadily eroding the comparative advantage that the Gulf countries enjoyed since the 1970s that allowed them to expand domestic industries with extremely low-priced associated natural gas.² Rapid industrial expansion, fueled by low-priced associated natural gas, caused high rates of natural gas consumption and energy intensity that strained the Gulf countries' ability to adequately supply their local markets with natural gas.

As a result of this demand pressure, the investment logic that caused energy-intensive industries to relocate to the region will have to concomitantly evolve. This is of

extreme importance when considering that due to the stresses of the Arab Spring, demographic growth, economic diversification, and pan-Gulf cooperation and integration, the Gulf countries will have to guarantee a sustainable economic model for their citizens.

In order to understand the contours of industrialization in the region and its connection with energy exports, the concept of absorptive capacity is essential to how energy-rich countries are able to domestically utilize revenue gained from oil and gas exports (Amuzega 1983, 21). The absorptive capacity of a state concerns bottlenecks of supply in the face of expanding demand. It also concerns the lack of profitable domestic investment opportunities for countries that have high governmental revenue from the export of energy resources (principally oil). There are two types of MENA energy-rich countries, the high absorbers and the low absorbers. Understanding this distinction will assist in understanding the policy choices available to the Gulf nations as they become more economically diversified.

The high absorbers are Algeria, Iran, Egypt and Iraq; countries with relatively large populations and relatively small per capita oil reserves (Amuzega 1983, 21). Additionally, these countries have a large manufacturing base, arable agricultural land, and overall, a much more diversified economic base (Luciani 1984, 107). The low absorbing countries, in contrast, are principally composed of the Arabian Gulf oil exporting countries and Libya, which have smaller populations, and large per capita oil reserves and GDP. However, they also lack a diversified economy, have a dearth of skilled manpower and have few complementary resources (Amuzega 1983, 21).

The concept of absorptive capacity is important because it impacts a country's economic growth trajectory, its domestic development strategy, and oftentimes, its political stability. Therefore, the countries that have the lowest absorptive capacity tend to export more energy to the global market (again, principally as primary products) as there are fewer profitable uses at home. As will be discussed in section 2.0, this dynamic of low absorptive capacity in the Gulf is evolving and placing enormous pressure on the ability of the Gulf countries, particularly Saudi Arabia, Oman, the UAE, and Kuwait, to continue their economic diversification plans while keeping a low administrative pricing framework (i.e., pricing set by policy as opposed to market forces).

This article proposes that Gulf policymakers implement natural gas pricing reconfiguration in order to moderate the region's high energy intensity rates and consumption, as well as to increase natural gas production. The Gulf governments need to increase natural gas prices to at least the cost of production for new gas reserves to be brought online and ensure profitable development of these fields. These new gas fields are, for the most part, non-associated fields, which means that in contrast to associated natural gas fields, they are standalone fields. And, in the context of the Gulf region, they are often complex as they contain ultra-sour (UAE), ultra-tight (Oman), shale (Saudi Arabia) or ultra-deep (Kuwait) natural gas. ³

The varieties of Gulf non-associated gas are expensive to produce, with the cost of production several times higher (approximately \$5-8 per MMBTU) than the current associated gas production (approximately \$.80-1.30 per MMBTU). The current natural gas pricing regime does not enable profitable production for non-associated gas fields

and thereby creates disincentives for expanding natural gas production. Furthermore, increasing natural gas prices will lower natural gas demand, which is currently at unsustainable levels.

Incorporation of these strategies will boost the region's gas production, while relieving the stress of year-on-year power and gas demand growth. While other initiatives are important, the most important step is the creation of an attractive pricing framework to spur development. From pricing reform, energy intensity would consequently be reduced as the industrial and residential sectors begin to reduce their energy consumption and as large industrial concerns begin to invest in energy efficient machinery. Of course, the above is not meant to be a comprehensive policy toolbox, as that is outside of the scope of this article. However, through the implementation of the basic elements of structural reform as indicated above, the energy-rich MENA countries would be able to definitively lower their rising energy demand and energy intensity while expanding the supply of available natural gas to continue on the path to economic diversification.

In section 2.0, this article analyzes the economic impact of expanding industrialization in the region and its impact on natural gas supply. As the majority of Gulf-based industries depend in some manner on natural gas provision, an expanding industrial base places significant demand pressure on the Gulf countries' ability to provide it. Section 3.0 offers an overview of the regional petrochemical sector and discusses the challenges facing the Gulf countries as they expand their petrochemical production, which is one of the primary industries used to diversify the regional economy. Section 4.0, the conclusion, recommends that the Gulf countries reconfigure

their gas pricing regime. Section 4.0 posits that, at least initially, Gulf natural gas price reconfiguration should not be comprehensive, rather it should be gradually liberalized in order to minimize any difficulties in managing the structural adjustment process. Furthermore, Section 4.0 argues that if gas price liberalization is not pursued, Gulf economic competitiveness will be severely hampered in the long-term.

2.0 Gulf Economic Transformation

When the Gulf countries began to economically develop in the 1970s, policymakers viewed natural gas as the best means to develop a domestic industrial base. For several decades since the 1970s, the Gulf countries poured investment into large industrial projects in a bid to reduce their dependence on hydrocarbon exports. Yet, since the beginning of the 2000s, several significant economic forces morphed the contours of the global energy sector, consequently impacting Gulf economic growth. The “second oil price revolution,” a period of increased oil prices from the year 2000-2008, reflected a slow but steady increase in oil prices to the triple digits that enriched the Gulf countries.⁴ During this time period, the GCC economies tripled in size to \$1.1 trillion dollars (Gulf Base 2009).

However, it was the global financial crisis that undercut what had seemed like an inexorable upward trend in Gulf economic growth. When fear of the global financial crisis climaxed in December of 2008, oil prices dropped precipitously to approximately \$30 per barrel. Combined with capital flight and constrained capital markets, the GCC countries were hit hard by the crisis, but relief was in sight as international oil prices began to steadily increase until reaching the current level of (at the time of writing in early March, 2013) of \$109.94 per barrel.

Despite the economic setbacks of the global financial crisis, the second oil price revolution heralded a period of unparalleled industrial expansion in the Gulf region. The Gulf countries initiated enormous value-added (petrochemicals, fertilizers), energy-intensive (cement, aluminum smelting) and power expansion projects in the region. Additionally, during the same time period, the regional population increased from 28 million to 39 million (Kombargi 2009, 2). The majority of the demographic bulge was composed of youth (under 25), which spurred the Gulf countries to focus on job creation as a tool to alleviate socio-economic discontent.

For the majority of the Gulf countries, the gas molecule has been at the center of plans for industrial expansion and economic diversification. This model of development did not pose any risks for the GCC countries until the expansionary pressure became too great by the mid-to late 2000s and the region's associated natural gas could not keep up with the growth in demand. By 2007, the widening supply-demand imbalance fissures became apparent.

The rapidly increasing regional demand for gas is driven by administrative pricing. These prices tend to be much lower than international prices of natural gas, and they are below the production cost of new gas fields. The Gulf States' internal pricing policies are causing allocation disruptions and exacerbating budgetary pressures because they cannot simultaneously supply low-price natural gas to their national industries while keeping their industrialization and diversification strategies on schedule.

When the majority of the natural gas produced was inexpensive and easily accessible (i.e., associated natural gas), this framework of providing low-priced natural

gas to domestic industry was viable. However, with regional gas demand increasing alongside rising upstream production costs in non-associated and difficult to produce (ultra-sour, tight, shale) natural gas fields, the current natural gas pricing framework is unsustainable.

Nonetheless, the major challenges are not just limited to the natural gas sector, regional oil demand is also increasing. This is due to two interrelated factors. Firstly, as natural gas shortfalls cascade through the regional economies, Gulf countries, such as Saudi Arabia, the northern Emirates, and Kuwait, are using more fuel oil for power generation. When oil is consumed domestically at below-market prices instead of exported at international market rates, a significant opportunity cost results. This contradiction is illustrated most clearly in Saudi Arabia. According to the International Energy Agency (IEA), Saudi Arabia currently consumes about 3 million barrels of oil a day and is also one of the world's most energy-intensive economies. As Saudi Arabia consumes more of its oil domestically, it loses a significant amount of foreign revenue. Moreover, in 2012, Saudi Arabia established enormous infrastructure and social spending programs, which will only increase domestic oil consumption. Rising oil demand is threatening Saudi Arabia's ability to serve as the global oil production hub, the loss of which could make global oil prices much more volatile.

Gulf countries also face growing economic pressures due to the massive expansion of government expenditures in the wake of the Arab Spring. A report by Merrill Lynch estimated that the combined social spending by Gulf countries to stave of social discontent to be approximately \$150 billion (Broomhall 2011). The ramping up of government spending programs has increased what is known as the "breakeven oil

price,” or the price of a barrel of oil required for an oil producing country to remain solvent. For example, the breakeven oil price for a barrel of oil in much of the region was approximately \$30 in 2003. Nearly a decade later, the regional breakeven oil price increased to approximately \$77 per barrel (Abed 2011 and Ijehadi 2011).⁵

The increase in the breakeven oil prices across the region indicates that the Gulf countries are becoming more fiscally vulnerable. Therefore the OPEC countries informally known as the “price doves” of OPEC will be forced by necessity to defend higher prices and thereby become “price hawks” (Schaeffer 2005, 259). It is clear that due to these pressures a bifurcated strategy is emerging within many Gulf countries, especially with Saudi Arabia. As the Gulf countries attempt to rely upon their comparative advantage and expand their industrial base so as not to rely solely upon oil exports, their industries “need” access to low-priced natural gas and oil to facilitate the process. However, simultaneously, as their economies expand and governmental expenditures increase through infrastructure development and subsidization of various economic sectors, there is a greater incentive to expand oil exports to capture the lost opportunity cost. Therefore, the Gulf countries, which were formally price doves, will likely become price hawks in the mid-term in order to support their massive budgetary outlays.

If coherent and clear-sighted energy policies are not developed, then the industrialization and economic diversification strategies of the Gulf countries will be at risk in the mid-to-long term. While inconceivable a mere decade ago, the region could face energy security problems if it is not able to expedite production of its own natural gas reserves. A lack of non-associated gas development would force the region to rely

upon the global market for natural gas import, as Kuwait and the UAE do at the moment. And, although unlikely to continue in a business as usual pattern, if Saudi Arabia's current oil consumption trends continue, it could potentially become an oil importing country by 2030 (Daya and El Baltaji 2012).

Additionally, the petrochemical sector, which is the basis of Gulf economic diversification, is also at risk by the lack of energy price reformation. The Gulf countries are attempting to transition away from hydrocarbon dependence and develop a diversified and sustainable modern economy. But, the low-cost pricing structure of natural gas is straining their ability to meet these strategic goals.

3.0 Threats to Diversification: A Focus Upon the Gulf Petrochemical Industry

The Gulf petrochemical industry is at a precarious point in its development. Its rapid expansion over the past two decades that was built upon low-priced natural gas enabled it to enjoy a substantial cost advantage over its global competitors. The Gulf countries staked their economic diversification plans on the continued availability of low-cost and low-priced associated natural gas. These countries considered associated natural gas the most cost-effective method to increase their non-oil related GDP (through downstream economic diversification), and create highly skilled jobs for their youth, of which a large proportion is under the age of 25.⁶

However, several issues obstruct the region's plans to expand capacity as petrochemical companies battle to preserve their profit margins in the face of ethane (a

crucial component for petrochemical production) shortages, which are further compounded by critical operational problems. The GCC's diversification drive to absorb rising population growth now includes energy intensive sectors such as steel and aluminum smelting, as well as upgrading and expanding the capacity of power and desalination sectors. All of these initiatives have placed extreme pressure on the GCC countries to effectively allocate natural gas amongst the various economic and industrial sectors. Because of this, ethane supply is not expected to increase over the coming decade, and most of the expected supply is already committed for allocation to existing projects.

Regional petrochemical companies have been adapting to the shortages of natural gas feedstock by utilizing liquid feedstocks (gas liquid and refined petroleum products such as naphtha and propane). Saudi Arabia, for example, ceased allocating significant amounts of ethane to the petrochemical sector in the middle of the last decade. However, the ethane shortfalls, which are present in nearly every Gulf country (except for Qatar), will make strategic expansion challenging. Liquid feedstock is now the feedstock of choice (or necessity) for the Gulf countries.⁷ For instance, Saudi Arabia Basic Industries Corp. (SABIC), the world's largest petrochemical producer, made the strategic decision to switch to propane and naphtha. The issue of where to source future natural gas feedstock allocations became ever more important in the Kingdom considering the approximately \$20 billion in current petrochemical expansion projects (Serrai 2011).

Another driver of the petrochemical boom has been the push to move deeper into the downstream value chain. By 2015, it is expected that at least nine new crackers will

be operational across the region as the GCC countries attempt to take advantage of robust Asian demand, especially for highly engineered plastics.⁸ As discussed above, this downstream diversification is part of the strategic goal to transition away from oil and natural gas export to the production of bulk petrochemical products, such as polymers for compounding plastics, and higher value specialty chemicals for use in the textile, electronic, construction, and pharmaceutical industries. Furthermore, the diversity of downstream production will enable the Gulf countries to meet their long-term goals of economic diversification, job creation, promotion of technology transfer of advanced machinery and industrial production techniques, stabilizing foreign revenue, and the creation more “value-addition” to petrochemical production.

The limited ethane feedstock, which has forced a number of Gulf countries to transition to more costly liquid and refined feedstocks, has eroded the comparative advantage of the petrochemical industry (most pronounced in Saudi Arabia). Furthermore, the pressure on the administrative pricing structure for natural gas will cause the Gulf countries to revise the natural gas pricing framework over the next several years. This will further degrade the Gulf’s comparative advantage and profit margins.

In terms of global competition, while the Gulf countries still have a comparative advantage even with the switchover to liquid and refined feedstocks (which is often provided at heavily discounted prices to domestic firms), the liquid and refined feedstock price is still several times higher than the price at which natural gas feedstock is supplied. Despite this, the Gulf’s price of liquid and refined feedstock is still less expensive than the price in the international market. Moreover, the current elevated

price of oil (averaging over \$100 per barrel) benefits the profit margins of Gulf petrochemical producers vis-à-vis their Asian competitors.

Asian petrochemical producers utilize, for the most part, crude-based naphtha, and will be obligated to have higher prices in order to preserve their profit margins. As a result of upward price pressure on Asian petrochemical producers, Gulf petrochemical companies will be able to raise their prices while still undercutting their Asian counterparts. Nonetheless, higher petrochemical prices will depress global demand, impacting all petrochemical producers.

4.0 Conclusion: Implementation of Natural Gas Pricing Reform

The resolution of the challenges of rising consumption and promotion of non-associated gas production lies in natural gas price reformation. Indeed, natural gas price reformation, if conducted with the utmost care so as not to unnecessarily disrupt economic growth, will have a stimulating effect and create true Gulf energy sector sustainability. The main motivation to reassess the current pricing regime in much of the region is to alleviate the impact of growing energy and power consumption, and as a consequence, significant energy deficits throughout the regional economies. The current energy pricing regimes exposed some energy-rich Gulf countries to a conundrum of being energy exporters to the world market, whereas at the same time, obliging them to import energy either through pipeline, LNG or refined petroleum products to supply rising domestic demand.

Regulated energy prices have also been an important means for some MENA states to attract large-scale Western energy-intensive and petrochemical companies to relocate to their jurisdictions and thereby assist in building up local capacity and technology transfer. Yet, price support mechanisms are not the most efficacious methods to promote allocative efficiency in times of energy shortages. In addition, energy price support mechanisms in the Gulf region constitute a significant portion of GDP and budget expenditures, even before the global financial crisis of 2008.⁹ Additionally, while low energy prices encourage consumption; it does not stimulate the requisite investment in needed energy infrastructure. Because the public utility sector often operates at a loss in the MENA region, the private sector is often hesitant to become involved and invest, and public utilities often do not make needed investments in energy efficiencies, upgrading and expansion of services.

That is why, in terms of energy pricing, there should be a dual-track pricing structure that aspires to gradual liberalization. It should be created so that the most economically productive sectors, such as petrochemicals, benefit from prices of at least the average cost of production for the non-associated gas reserves in that particular country. This pricing structure would, at a minimum, economically support extraction of the most difficult non-associated gas fields and encourage international oil companies to invest their capital, time, expertise and technology in its production.

When considering the power sector, market regulators should allow for power tariffs to meet the power generation cost. This would ensure that the electricity service is uninterrupted. In the residential sector, the price framework should be set at cost-plus (the cost of production plus a predetermined amount over the basic production cost) to

guarantee a return on investment for the power sector, which would create incentives

Box One: Case Study: Price Reform in Oman

Oman, the first among its regional peers, took the revolutionary step to stimulate development of its tight gas reserves by creating a new price regime. This new policy is based on the fact that unconventional gas production in the country will exceed, based on capital investment and operating costs, \$2 per MMBTU. This estimated production cost is much higher than the previous regulated feedstock price of approximately \$0.77 per MMBTU for many industrial users, such as Oman India Fertilizer Company (OMINFO), and higher than the average gas prices of approximately \$0.80/MMBTU for all consumers.

After fourteen months of prior negotiation with major industrial and power consumers, the Omani Ministry of Oil and Gas implemented a revised pricing scheme for feedstock and fuel, to increase natural gas prices to \$3 per MMBTU, which was to begin on Jan. 1, 2012, for these two sectors. But, faced with stiff resistance, Oman revised its initial increase to some industrial consumers, such as OMINFO, and instead halved the price to \$1.50 per MMBTU with an annual escalation clause of \$0.50 until it reaches the target price of \$3 per MMBTU. After it reaches the target price of \$3 per MMBTU in the next 3-4 years, the following annual escalation in the feedstock rate would be equivalent to either 3 percent or the per annum US inflation rate, whichever is lowest. The price modification, while painful in the short term, would make unconventional gas production and the *Vision Oman 2020*, a detailed program to foster a sustainable industrialization and economic diversification for the long term, a practical reality.

for energy efficiency upgrades and capacity expansion to promote energy access.

However, for citizens that meet a certain poverty level, regional governments should create a cash disbursement mechanism to mitigate the social cost associated with structural adjustment, as well as the financial burden on the impoverished.

Reform has already taken hold in Oman. Oman is a country that faces considerable internal contradictions in its energy sector, yet its far-reaching energy pricing reformation (see Box One) has gone the furthest when compared to Gulf peers. It has increasing domestic demand from the power and petrochemical sectors, as well as demographic growth, all of which are compounded by demand from water desalination and fertilizer projects. Oman, as a result of the growing demand, imports natural gas from Qatar's North field through the Dolphin pipeline project of 5.66 million

cubic meters per day (5.66 MCM/d). Oman also exports LNG to the global market, principally to South Korea, but also to other markets. In addition, it diverts a significant amount of natural gas to its oil field reinjection program to sustain production. Due to the above mentioned trends, Oman aggressively attempted to produce non-associated natural gas (mostly tight gas).

As part of its development project, Oman is developing an approximately \$15 billion tight gas project in Block 61 (including the Khazzan and Makarem fields, in north central Oman). If production begins as planned, Block 61 will be the largest gas project ever undertaken in the sultanate. The successful completion of the development of the Khazzan and Makarem fields would grant Oman approximately 849 BCM in reserves with the first phase of the project producing 12.4 BCM from early 2015. This would increase Omani gas production by approximately 40 percent.¹⁰

Implementing natural gas price reform is essential in the Gulf region if the countries wish to be able to supply enough natural gas to their petrochemical sectors in the mid-to long-term. Additionally, there is significant competition on the horizon, such as the massive increase in shale gas production in the United States, known as the “shale gas revolution,” the coal-to-olefin initiatives in China, and the new gas fields coming online in other parts of the world, such as Iraq, all which pose additional challenges for Gulf petrochemical dominance.

US shale gas production has lowered natural gas prices, and American and International chemical companies are attempting to transform this into petrochemical dominance. Shell is currently exploring building a world-scale petrochemical complex in

the Appalachian region near sites of gas production in the Marcellus shale formation. This development may augur a return of major American petrochemical producers from the Gulf to the US. Several international energy and petrochemical companies such as Westlake Chemical, Braskem, Dow Chemical, and Nova Chemicals have either expressed interest or begun the initial process of developing sites in the US to take advantage of the low cost natural gas feedstock.

China has similarly developed plans to produce between 60 and 100 billion cubic meters of shale gas by 2020, which will directly threaten the Gulf petrochemical sector. Another potential threat may come in the form of a World Trade Organization (WTO) suit against the Gulf countries for supplying natural gas and liquid/refined feedstocks below international market prices to their petrochemical producers. In 2009, China and India imposed punitive anti-dumping tariffs against Gulf petrochemicals, and the EU followed suit in 2010 with a schedule of tariffs on producers of polyethylene terephthalate in the UAE.

The US and Western European countries also threatened to bring a suit in the WTO under the Agreement of Subsidies and Countervailing Measures (ASCM) for alleged subsidies granted to the Gulf petrochemical industries by their governments. Pressure from the WTO is also causing the Gulf countries to seriously consider revising their natural gas prices upward and allowing them to fluctuate based on market forces. But, in terms of the broader Gulf diversification plans, with price reform, in the mid-term, the petrochemical ventures in the Gulf region will be forced to become leaner enterprises. They will be focused on preserving profit margins and increasing operational efficiency, while at the same time integrating a higher production cost

structure for their feedstocks. These steps, while slightly painful in the beginning due to the structural adjustment costs, will assist in creating Gulf economic sustainability for the long-term.

References

- Abed, George, et al. 2011. *The Arab World in Transition: Assessing the Economic Impact*. The Institute of International Finance, May 2. Accessed March 25, 2013. <http://www.iif.com/emr/resources+1200.php>
- Amuzega, Jahangir. 1983. *Oil exporters' Economic Development in an Interdependent World*. Washington, DC: International Monetary Fund. http://books.google.com/books?id=yThTsCppT4wC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
- Arab News. 2012. "GCC Oil and Gas Reserves Worth \$65 Trillion." Last modified March 11. <http://www.arabnews.com/node/408471>
- BP. 2011. "BP Annual Statistical Review of World Energy June 2011." Accessed March 24, 2013. http://www.bp.com/assets/bp_internet/globalbp/globalbp_uk_english/reports_and_publications/statistical_energy_review_2011/STAGING/local_assets/pdf/statistical_review_of_world_energy_full_report_2011.pdf
- Broomhall, Elizabeth. 2011. "Arab Spring has Cost Gulf Arab States \$150 bn." *Arabian Business*, September 8. Accessed March 25, 2013. <http://www.arabianbusiness.com/arab-spring-has-cost-gulf-arab-states-150bn-419429.html>
- Daya, Ayesha and El Baltaji, Dana. 2012. "Saudi Arabia May Become Oil Importer by 2030, Citigroup Says." *Bloomberg*, September 4. Accessed March 25, 2013. <http://www.bloomberg.com/news/2012-09-04/saudi-arabia-may-become-oil-importer-by-2030-citigroup-says-1-.html>
- Economist Intelligence Unit. 2009. "The GCC in 2020: Outlook for the Gulf and the Global Economy." *The Economist*, March. <http://graphics.eiu.com/marketing/pdf/Gulf2020.pdf>
- Gulf Base. 2009. "GCC Economic Overview." Accessed March 24, 2013. <http://www.gulfbase.com/GCC/AboutGCC?pageID=93>
- Ijtehadi, Yadullah. 2011. "Testing Breakeven Oil Prices." *Gulf Business*, Dec. 29. Accessed March 25, 2013. <http://gulfbusiness.com/2011/12/testing-breakeven-oil-prices/#.UVAA97SJW0s>

International Energy Agency. 2012. *Oil Market Report*. February 10. Accessed March 25, 2013. <http://omrpublic.iea.org/omrarchive/10feb12full.pdf>

Kombargi, Raed, et al. 2010. *Gas Shortage in the GCC: How to Bridge the Gap*. Booz & Co. Accessed March 23, 2013. http://www.booz.com/media/uploads/Gas_Shortage_in_the_GCC.pdf

Luciani, Giacomo. 1984. *The Oil Companies and the Arab World*. New York: St. Martin's Press.

Schaeffer, Robert K. 2005. *Understanding globalization: the social consequences of political, economic, and environmental change*. Lanham: Rowman & Littlefield. http://books.google.com/books?id=CBU5RIKd79kC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Serrai, Rabih. 2011. "Saudi Arabia Investing \$20 Billion in Petrochemicals Industry." *Global Arab Network*, September 2. Accessed March 25, 2013. <http://www.english.globalarabnetwork.com/2011090211857/Industry/saudi-arabia-investing-20-billion-in-petrochemicals-industry.html>

¹ Throughout this article, the terms "the Gulf" and "Gulf countries" will refer to the six countries of the Gulf Cooperation Council, i.e., Saudi Arabia, Kuwait, Bahrain, the UAE, Oman and Qatar.

² Associated natural gas is natural gas that is produced alongside oil in a joint reservoir. Non-associated natural gas is standalone natural gas with minimal oil deposits.

³ Shale gas is natural gas trapped between shale formations. Tight gas is refers to natural gas reservoirs locked in extremely impermeable hard rock. Tight gas can also be trapped in particularly nonporous sandstone or limestone formation. Sour gas is gas that has high concentrations of hydrogen-sulfide, thereby causing it to be more complex to process. Additionally, deep gas is gas found at low depths beneath the surface.

⁴ The first oil price revolution was the several fold price increase that occurred in the wake of the OPEC oil embargo of 1973.

⁵ The Institute of International Finance estimates that the current Saudi breakeven price per barrel of oil is \$85. However, within the region, there is significant variability, at the low and high end of the spectrum, Qatar has a relatively low breakeven price of \$45, while Bahrain requires \$103. The UAE's breakeven oil price has risen to the highest in the GCC, estimated to be approximately \$107 per barrel.

⁶ The CIA World Fact Book, for example, states that in Saudi Arabia, approximately forty percent of the population is under 14 years old.

⁷ For instance, the Dow Jones-Aramco joint venture (Sadara) and the Rabigh Refining and Petrochemicals Co. in Saudi Arabia will be supplied primarily with liquid feedstocks, while Kuwait and the UAE have similar plans.

⁸ Hydrocarbon cracking is the process of breaking long-chain hydrocarbons into short ones and thereby develop various petrochemical products.

⁹ The global financial crisis had a double-edged impact on the region. To a certain extent; for energy exporting countries, it lessened the opportunity cost of domestic consumption, but it lowered (for a brief period) governmental revenue to an unsustainable level. For the energy importing countries of MENA, it offered a brief respite to high energy prices and granted some succor to their impoverished citizens as commodity prices across the board briefly dipped.

¹⁰ Oman is also committed to developing tight gas in Block 42 in the Sharqiyah region and the Abu Tubul gas field in Block 60 in central Oman.