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Summer Again: The Swing in Oil Demand in Saudi Arabia[1]

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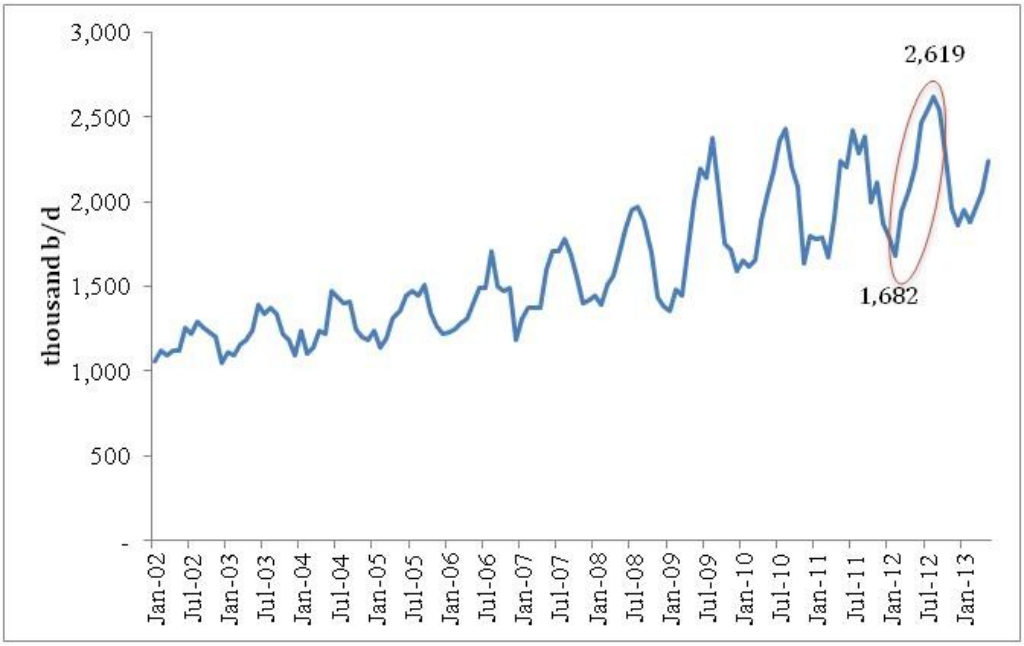
It is the time of the year when Saudi Arabia's domestic energy consumption is in the limelight. During the summer, Saudi Arabia faces some of its sharpest upward swings in oil demand (see Figure 1), raising some market concerns about its export potential during those months. In 2011, the swing in Saudi demand – from winter lows to summer highs – was 750,000 b/d while in 2012 the swing was close to 1 million b/d. A similar upswing in oil demand of around 1 million b/d is also expected this summer, boosted by the fact that Ramadan this year has fallen in the hot months of July and August. The latest available data for 2013 indicate that in May, oil demand had already reached 2.238 million b/d, registering a month-on-month increase of 175,000 b/d. Most of the growth is accounted for by fuel oil (which registered a month-on-month increase of 94,000 b/d) and crude oil (which registered a month-on-month increase of 169,000 b/d). These sharp demand swings could influence oil prices, especially at times when the call on Saudi output is high and rising and when oil fundamentals are perceived to be tight.

Figure 1: Saudi Arabia Domestic Consumption of Liquids (thousand b/d)



Source: JODI, Energy Aspects

[1] This article is based on 'Crude keeps the lights on in the Kingdom' published by Energy Aspects.

The Power Sector in Saudi Arabia

In order to understand the underlying dynamics behind such swings in oil demand, it is important to focus on the structure of the power sector and the evolution of the fuel mix in this sector. During the last decade, the power sector has been a key source of oil and gas consumption growth. The Saudi Electric Company (SEC) – the largest utility in the country, which accounts for around 77 per cent of installed capacity[2] – alone consumed 363 million barrels of oil equivalent (boe) or around 995 thousand boe per day (boe/d) in 2011.[3] While the data for the total power sector's consumption are not publicly available, 'back of the envelope' calculation implies a total consumption of liquid fuels and gas exceeding 1.2 million boe/d, making the power sector one of the largest energy consuming sectors in the Kingdom.

One of the key features seen in Saudi Arabia over the last decade is the rapid increase in electricity demand driven by multiple factors such as population growth, robust economic growth, improvements in standards of living, harsh weather, and an economic policy geared toward diversification into energy intensive industries, together with a low energy pricing policy that encourages 'wasteful' consumption and creates wide distortions in the economy. Between 2003 and 2012, electricity sold (a proxy for electricity demand) increased from 128,629 million kWh to 240,288 million kWh, an increase of 78 per cent. During the same period, the peak load increased from 23,938 MW to 51,939 MW, an increase of 117 per cent.

The biggest consumer of electricity is the residential sector (which consumed 50 per cent of electricity generated in the Kingdom in 2012); this is followed by industry (17 per cent), commercial entities (16 per cent), and governmental agencies (13 per cent).[4] Around 70 per cent of residential consumption is attributed to air conditioning. Electricity is sold at highly subsidized prices, ranging from 1.3 to 6.9 US cents per kilowatt hour depending on the type of end user, the consumption bracket, and the time of use. Recently, the government has embarked on gradual reform of electricity prices; in 2010 electricity tariffs were revised upwards for the industrial, government, and commercial sectors but not for the residential sector. Despite these increases, electricity prices in the Kingdom remain very low even by regional standards.

The Fuel Mix in the Power Sector

The power sector in Saudi Arabia relies heavily on liquid fuels. In 2012, natural gas and crude oil accounted for almost equal shares of around 39 per cent and 35 per cent respectively followed by diesel (20 per cent) and fuel oil (6 per cent). In 2007, the share of natural gas was 52 per cent, which means that its share of the total fuel mix has fallen substantially over the five-year period. Natural gas and/or combined cycle had formerly been expected to drive the capacity expansion in power generation. However, there was a change of policy in 2006 when the government issued a Royal Decree stating that the country's largest power plants, which had initially planned to rely on gas, would in the future be fired by crude oil provided at a subsidized price. Therefore, the volume of gas consumed in power generation is now expected to remain unchanged or to increase marginally, reducing its share of the fuel mix in power generation over time. A big switch back to gas remains a possibility, but this policy shift will only materialize if large gas reserves are discovered and/or if Saudi Arabia changes

[2] The remaining installed capacity is distributed across a number of small producers including Saline Water Conversion Corporation (SWCC), Jubail Water and Power Company, Marafiq, and Saudi Aramco. SEC has a monopoly on transmission and distribution to consumers of electric power in the Kingdom. In order to improve the management and efficiency of the electricity sector and rationalize production and utilization of electricity, the Council of Ministers issued Resolution No. (169), dated 11/8/1419 (1998), calling for the restructuring of the electricity sector to include increased private sector participation, but little has been done on this front to date.

[3] ECRA Annual Report 2011.

[4] ECRA Annual Report 2011.

its current policy and starts importing natural gas. Without a clear commitment to a regular flow of natural gas supplies at attractive prices, investors in new generation capacity will be reluctant to invest in gas-fired power generation.

The power sector obtains the various fuels at a fraction of the prices prevailing in international markets. Table 1 below shows the prices paid by power producers in the Kingdom compared to international prices. Such low prices discourage the power sector from undertaking necessary investment in efficiency measures, and reduce the incentive to shift to alternative sources of fuel such as renewable or nuclear. Despite the low cost paid for fuel, in 2012 the average cost of a unit of electricity in the Kingdom (15 Halala per kWh) was higher than the average price collected from consumers by the SEC (14.2 Halala per kWh). If the fuels had been priced at international levels, the average cost of a unit of electricity would rise to 80 Halala per kWh.[5]

Table 1: Prices Paid by Power Producers in Saudi Arabia compared to International Prices in 2012 ($/MMBTU)

Fuel	Price Paid by Power Producers	International Price
Heavy Fuel Oil	0.43	15.43
Natural Gas	0.75	9.04
Diesel	0.67	21.76
Crude Oil	0.73	19.26

Source: Electricity & Cogeneration Regulatory Authority (ECRA) Annual Report 2012

Regional Demand and Implications for Fuel Use

The SEC defines four areas for its operations: Central, Eastern, Western, and Southern. The Eastern region accounts for 37 per cent of installed capacity, followed by the Western region (34 per cent), the Central region (21 per cent), and finally the Southern region (8 per cent). While in the Eastern and Central regions natural gas is the dominant fuel for power generation, it does not enter the fuel mix in the Western and Southern regions (see Table 2). Since most of the Kingdom's gas is produced and processed in its Eastern province, the dominance of gas in the power sector of that region should not come as a surprise. In the Western region, crude oil is the dominant fuel in the power mix while in the Southern region it is diesel. This reflects the lack of adequate infrastructure capable of shifting natural gas from the production and processing centres (mainly in the Eastern region) to the Western and Southern regions.

Table 2: Fuel Consumption by operating region in 2011, mboe

Region	Crude Oil	Natural Gas	Diesel	Heavy Fuel Oil	Total
Central	41	52	12	0	***105***
Eastern	23	81	11	0	***115***
Western	61	0	27	18	***106***
Southern	9	0	25	0	***34***
Total	***134***	***133***	***75***	***18***	***360***

Source: ECRA

[5] ECRA Annual Report 2011

It is also interesting to note that in all four regions there is a large variation in monthly electricity demand over the year (see Table 3). In the Central region, demand in February and March in 2011 was in the range of 3.9–7.5 GW compared to a range of 8.2–14.5 GW in August 2011. In the Eastern region, demand reached its lowest level in February with a range of 6.9–8.8 GW, compared to 10.4–14 GW in August. The largest variation was in the Western region, where demand reached its lowest level in January with a range of 3.6–7 GW, compared to 9.1–14.5 GW in August. In the Southern region, the variation is much smaller; demand reached its lowest level in January with a range of 1.3–2.5 GW, compared to 2.4–3.5 GW in July and August.

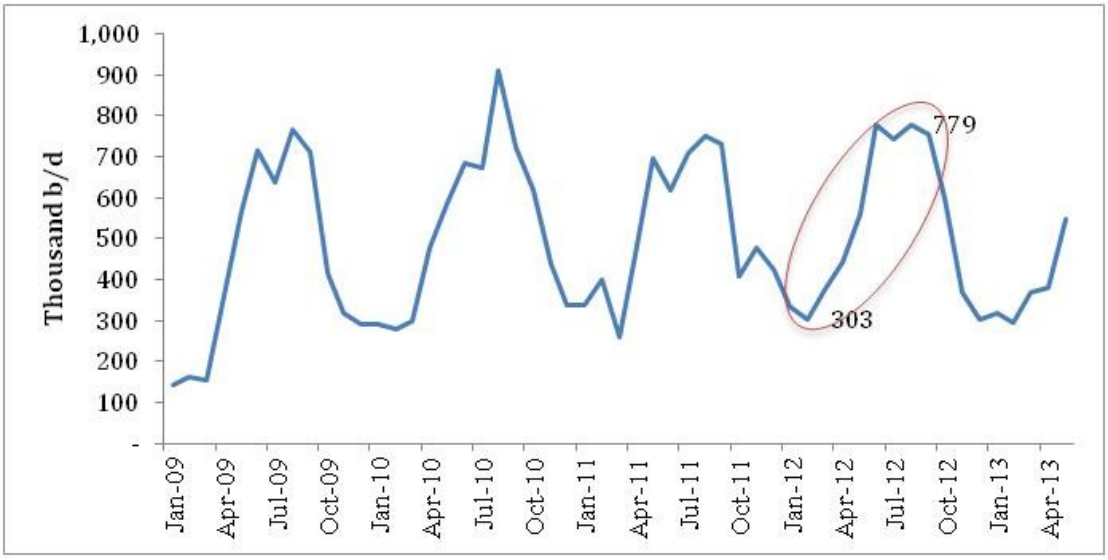
Table 3: Demand variation by region in 2011, GW

Month	Central		Eastern		Western		Southern	
	Max	Min	Max	Min	Max	Min	Max	Min
Jan	8.3	4.2	8.9	6.7	7	3.6	2.5	1.3
Feb	7.3	3.9	8.8	6.9	7.4	3.8	2.6	1.5
March	7.5	3.9	9.4	6.9	7.8	3.9	2.6	1.5
April	9.6	4.5	10.8	7.4	10.1	4.9	3.2	1.7
May	13.3	6.8	12.7	8.6	12	6	3.3	1.6
June	14	9.3	13.3	10.3	12.3	8	3.6	2.4
July	14	9.7	13.6	10.4	13.5	8.5	3.5	2.4
Aug	14.5	8.2	14	10.4	14.5	9.1	3.5	2.4
Sep	13.2	8.6	13	99	12.3	7.8	3.4	2.4
Oct	12.1	5.5	12.7	80	11.9	6.6	3.3	1.9
Nov	8.4	4.1	10.2	72	9.2	4.2	2.9	1.1
Dec	9	4.8	9.4	73	8	4	2.8	1.3

Source: ECRA

In order to meet surges in electricity demand during the summer, the government is forced to increase direct crude burn in power generation, especially in the months of July and August. The swings in crude burning can be very large; in 2012 the size of the swing between February and August was 476,000 b/d with crude burning reaching 779,000 b/d in August that year (see Figure 2). The latest available data for 2013 indicate that crude burn had already reached 547,000 b/d in May.

Figure 2: Saudi Arabia Direct Crude Burn (thousand b/d)



Source: JODI, Energy Aspects

Short-term Options

In the short term, Saudi Arabia has few options to deal with the challenge of reducing crude burn in the power sector:

- it can use fuel oil and diesel instead of crude oil (often imported during summer);
- it can accumulate oil stocks during periods when demand is low and use these stocks during periods when demand is high; and
- it can increase the use of gas in power generation to free more crude oil for exports.

The last option has been strongly emphasized by Saudi officials. The Saudi Oil Minister Mr Ali Al-Naimi has been quoted on more than one occasion as saying that more natural gas would be made available to meet peak power demand, potentially freeing crude oil for exports during the summer months. Indeed, faced with rapid increase in gas demand by industry and the power sector, Saudi Aramco has been under pressure to develop its natural gas reserves. In the early 2000s, development of the Empty Quarter constituted the cornerstone of the Kingdom's gas strategy. However, this has been replaced by the development of non-associated gas fields, as exploration results in the Empty Quarter have proved to be disappointing so far. This represents a change in the Kingdom's gas strategy, towards developing the more complex, more challenging, and more costly non-associated gas reserves, while in a low domestic gas price environment. Currently, the price of natural gas in Saudi Arabia is one of the lowest in the region ($0.75 per MMBTU) with the region itself having the lowest prices of natural gas in the world.

In 2012, Saudi Arabia's gas production (raw gas to gas plants) amounted to 10.72 bcf/d with a target of increasing production to 15.5 bcf/d by 2015. To meet this gas production target, two big projects are currently being developed. The first is the Karan field, the first non-associated offshore gas increment in the history of the Kingdom, located in Saudi territorial waters of the Gulf. Karan has been fast-tracked and was completed in 2012, ahead of schedule. The field produces 1.8 bcf/d (18 bcm) of raw dry gas and feeds into the Master Gas System. The second project is the development of the Hasbah/Arabiyah fields, also located in the Gulf. When on stream, Arabiyah and Hasbah are expected to produce 1.2 bcf/d (12 bcm) and 1.3 bcf/d (13 bcm) of gas respectively.

Assuming that Saudi Aramco meets its gas output target on time, will this reduce the size of the upswing in oil demand during summer in the next few years? The straightforward answer to this question is 'only very partially'. First, the increase in gas production will not be able to meet the rapid increase in gas demand by the industrial and the power sector. Second, the main new gas discoveries are located in the Gulf and thus can feed into the power plants of the Eastern and Central region where natural gas is already a large component of the fuel mix. Extra gas could be utilized in the power plants of these regions, but only up to a certain point, as there are technical barriers to such substitution. Furthermore, due to infrastructure constraints, these new fields can't feed into the power plants of the Western and Southern regions. The infrastructure to shift natural gas to these regions is not yet in place and there are currently no plans to undertake such a project. In fact, until large quantities of gas are found, the Saudi government is unlikely to build the required infrastructure, especially as much of the gas produced can be utilized within the Eastern region in the rapidly expanding petrochemical sector.

One potential source of gas supply to power plants in gas-starved regions is the Midyan field in the northern Red Sea. There are already plans that new gas discoveries there will be developed for power generation in the north-western part of Saudi Arabia, to replace crude oil and diesel burning in the area. The discovered gas amounts, however, remain too small to change the dynamics in any significant way, but the gas production target for the Midyan field has been revised upwards from 50 to 75 million standard cubic feet per day for a 20-year period. The project is expected to come on stream in 2015.

The other option is to rely on fuel oil and diesel, which are often imported during summer. To help meet the rapid increase in domestic demand, Saudi Arabia has invested heavily in expanding its refining capacity. Saudi Aramco is pushing ahead with three new refineries: SATORP (Saudi Aramco Total Refining and Petrochemical Company, a joint venture with Total) in Jubail; YASREF (Yanbu Aramco Sinopec Refining Company, a joint venture with Sinopec) in Yanbu; and Jazan (Saudi Aramco alone); each of which is planned to have a capacity of 400,000 b/d. When these refineries come online, between 2013 and 2016, Saudi Aramco would have more flexibility to use increased amounts of fuel oil and diesel in power generation, reducing its reliance on direct crude burn. Thus, although Saudi Arabia may make a conscious effort to limit the upswing in domestic crude burn, various oil products, be they diesel or fuel oil, will remain key in meeting the country's demand needs.

Medium-term options

In the long term, Saudi Arabia has more options. There is the route of adjusting the prices of natural gas, petroleum products, and electricity prices to reflect the true cost of these resources, which would help to rationalize demand and slow energy demand growth. However, the government is unlikely to change the price of the fuels used by the power sector without first undertaking a comprehensive reform of the electricity sector and electricity prices. Fuel price adjustment would entail higher costs for the basic services electricity and water (if these price rises are allowed to pass through to final consumers), thereby fuelling inflation, which is politically very challenging, especially in the aftermath of the Arab Spring.

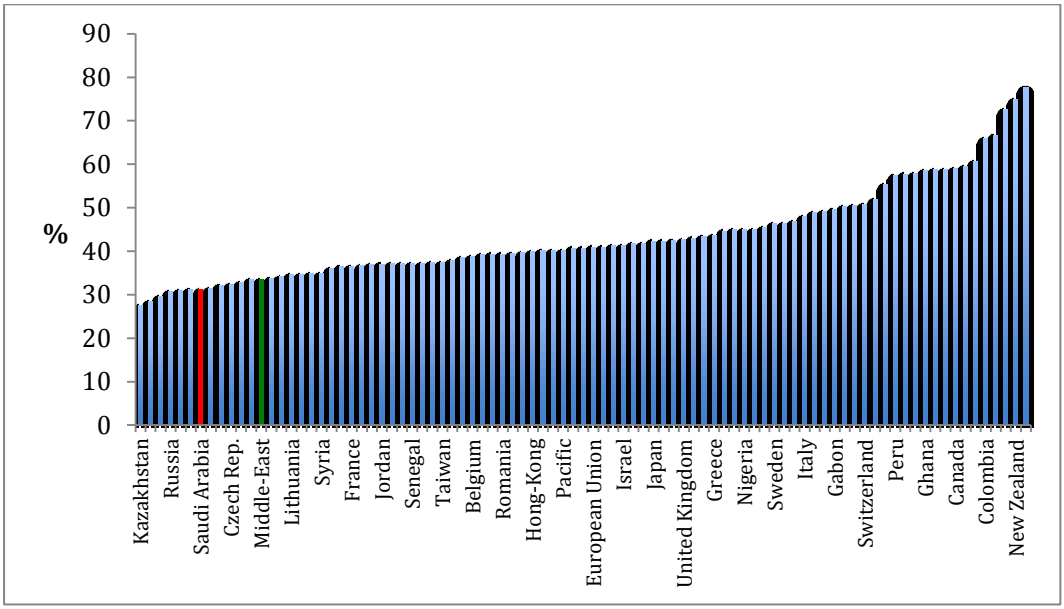
Currently, Saudi Arabia is pursuing a three-track strategy: change the energy mix in the power sector, improve efficiency of the power sector, and reduce demand at the consumer end by improving energy efficiency. Saudi Arabia is pressing ahead with its ambitious plans to develop nuclear power to meet rising electricity demand and save oil for export. It has plans to build 16 nuclear reactors over the next 20 years, spending an estimated $7 billion on each plant, to provide one-fifth of the Kingdom's electricity for industrial and residential use and for desalination of seawater. The government has also plans to generate some solar electricity and is also considering wind, waste, and geothermal energy sources as it seeks to reduce

reliance on oil and gas. The Kingdom has a $109bn investment plan to create a solar industry that would generate a third of the country's electricity by 2032.

Saudi Arabia may also consider importing LNG, which would provide it with much-needed flexibility, without heavy investment in gas processing plants and pipeline infrastructure (although the Kingdom will have to invest in regasification capacity). This, however, poses challenges, as there would be a large gap between the price of gas sold in the domestic market and that of gas imported from international markets. This could also raise some issues with the WTO. One of the key factors that delayed Saudi Arabia's accession to the WTO was the pricing of natural gas for the petrochemical sector. The EU was of the view that low gas prices for petrochemicals should be treated as subsidies, thus prices below international levels constituted an unfair advantage. Saudi Arabia's response rested on the fact that it does not export natural gas and hence the WTO members should take into consideration the cost of liquefying and exporting gas against the cost of using natural gas as feedstock for domestic industry. Importing gas at higher international prices and selling it domestically at lower prices would reopen the subsidies issue. So far, there is no indication that the Kingdom will pursue the gas import option, particularly as plans to increase gas supplies are on target. Thus, for the foreseeable future, Saudi Arabia's gas policy is unlikely to change and will be based on a programme of aggressive exploration and development targeted at non-associated gas reserves, in other words Saudi Arabia will continue to pursue a policy of self-sufficiency in natural gas and reliance on liquid fuels to meet the gap in the power sector.

There is also scope to improve efficiency in power generation. The Saudi power sector's efficiency in comparison to other parts of the world is quite low, falling well below the world average (see Figure 3) implying that there is scope for large efficiency improvements in its power sector. The Kingdom has already put in place a programme to phase out old power plants and introduce more efficient ones. This could also alter domestic demand dynamics quite significantly, though it is doubtful whether this programme can be effectively implemented without a more rational pricing policy.

Figure 3: Efficiency of power generation in 2010



Note: Measured by dividing total net electricity production by energy inputs, Source: 'Trends in Global Energy Efficiency', ABB, 2011.

Conclusion

While Saudi Arabia has some options in the long term (post 2020), the consumption of liquid fuels in the power sector will continue to present a challenge for Saudi policy makers in the short to medium term. For the next few years, liquids consumption by the power sector will continue to increase at a rapid pace, driven by rapid growth in electricity demand, low energy and electricity prices, and by infrastructure and technical constraints which will prevent higher penetration of gas in the power sector. Consequently, the upswing in oil demand during summer will persist and thus Saudi domestic demand will continue to be closely monitored by markets analysts and will continue to be one of the many factors affecting oil market balances and oil price behaviour, especially in some key months, when oil market fundamentals are perceived to be tight and when the market expects the call on Saudi Arabia to rise.