
The Gulf Countries' Energy Strategies

What's on the Menu for the Power Sector?

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September 2012



**Gouvernance européenne
et géopolitique de l'énergie**

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ISBN: 978-2-36567-061-6
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Introduction

The futuristic green city of Masdar in the United Arab Emirates or the latest announcements of Saudi Arabia which might now well become the new Eldorado for solar energy companies have a clear marketing varnish. But if they are showcases of green ambitions, they nonetheless reflect the situation the Gulf States face today driven by the development driven by the development of heavy industry and petrochemicals but first and foremost by the rapid population growth (around 2% for Saudi Arabia and 3% for Kuwait; Qatar and the Emirates have higher population growth rate due to immigrants). Demand for power is rising as fast as buildings, even more so as most of the water consumed is desalinated. While their economies still largely depend on oil and gas revenues, burning increasing amounts of fuels domestically into power stations is not sustainable. These countries are facing an energy paradigm with serious implications. Faced with this challenge, the Gulf States are thinking of solutions. They are moving at different speeds towards the diversification of power generation sources and the restructuring of their power sector. Recent years have therefore evolved under the banner of reform and a strong institutional activity in most states.

This comparative study intends to evaluate the energy paradigm in the GCC, and the responses given by some of the monarchies. This paper is written in the middle of the reform process, and therefore does not claim to evaluate the results of these measures. Rather it looks at the speed at which these reforms are being undertaken, the tools used and advantages across the countries, and the type of reforms that are conducted. It focuses on three specific countries: Saudi Arabia, the UAE and reports on other states to a lesser extent. The final section assesses the impact of the economic crisis and the regional political turmoil on the reform process. This paper argues that while high oil prices provide a large tax base for states investments in new and alternative power generation, the fear of the contagion of political turmoil will slow the privatization process and hamper price reforms. Additionally, the global credit crunch could have a negative impact on power plants tenders.

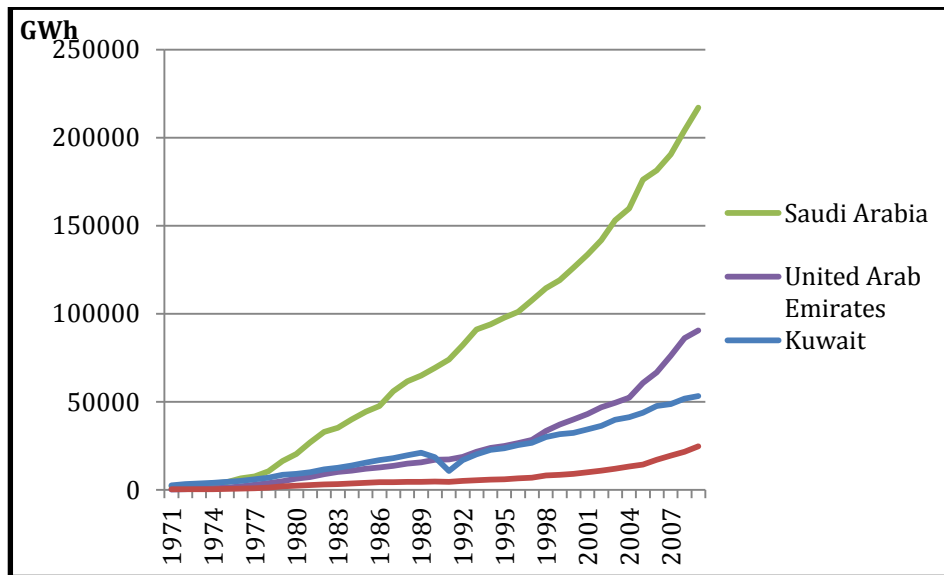
Common Energy Challenges across the GCC Countries

The Gulf monarchies are all facing growing domestic energy consumption, especially in their power sectors, despite already having per capita consumption rates which are among the highest in the world. This fast consumption growth – from 6% to 10% per year – is partly explained by the rapid development of fuel-consuming sectors such as petrochemicals, and heavy industries which are large oil consumers (iron & steel, cement and glass), but also electricity consumers (for instance aluminum smelting). The rising population is nonetheless the main factor, as revealed by the power consumption breakdown in which the residential and commercial sectors account for the largest shares. The explosion of real estate construction and the lack of energy efficiency measures for buildings have resulted in a surge in air conditioning installations. Air conditioning in Kuwait for instance accounts for 70% of the peak electricity demand during summers.

The growth of power consumption also results from increased water use. Water desalination techniques, such as multi-stage flashing or reverse osmosis, can desalinate large volumes of water at a lower cost by coupling it with power generation.

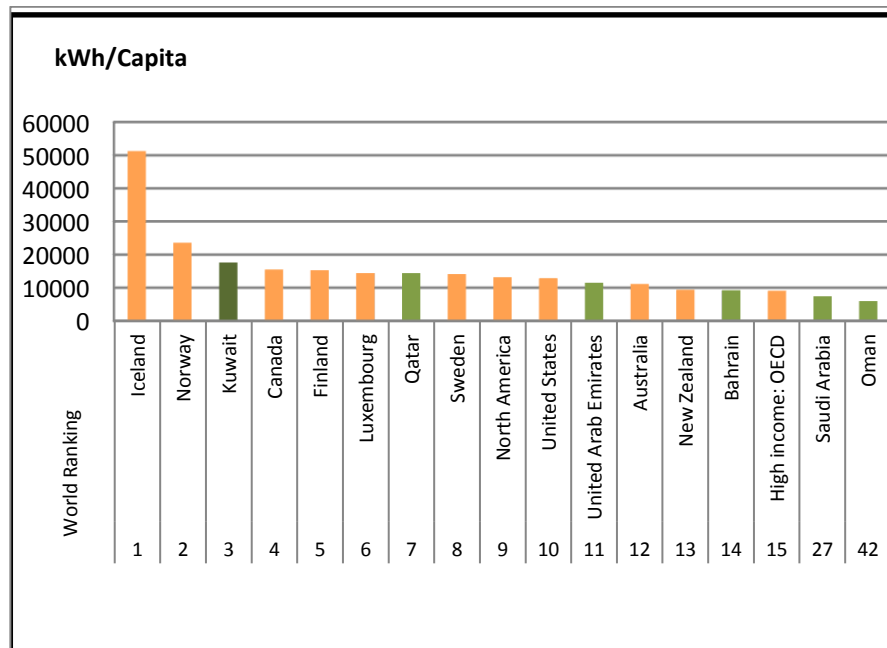
The rate of power consumption has also probably not reached a saturation level either: In Saudi Arabia and the UAE pursue large petrochemical projects; Kuwait's new development plan consists largely of construction projects will further drive up air conditioning demand, and the planned construction of a fourth refinery will require additional fuel; in the UAE, the real estate sector has slowed down with the crisis, but nevertheless continues to grow. Wasteful habits have been encouraged by very low electricity and fuel prices across the Gulf countries. Energy voracious buildings or low efficient cars have now in turn the effect of locking in consumption into very high levels.

Graph 1: Growth of Power Consumption over the last ten years in selected GCC countries



Source: IEA Data

Graph 2: World Ranking of Power Consumption



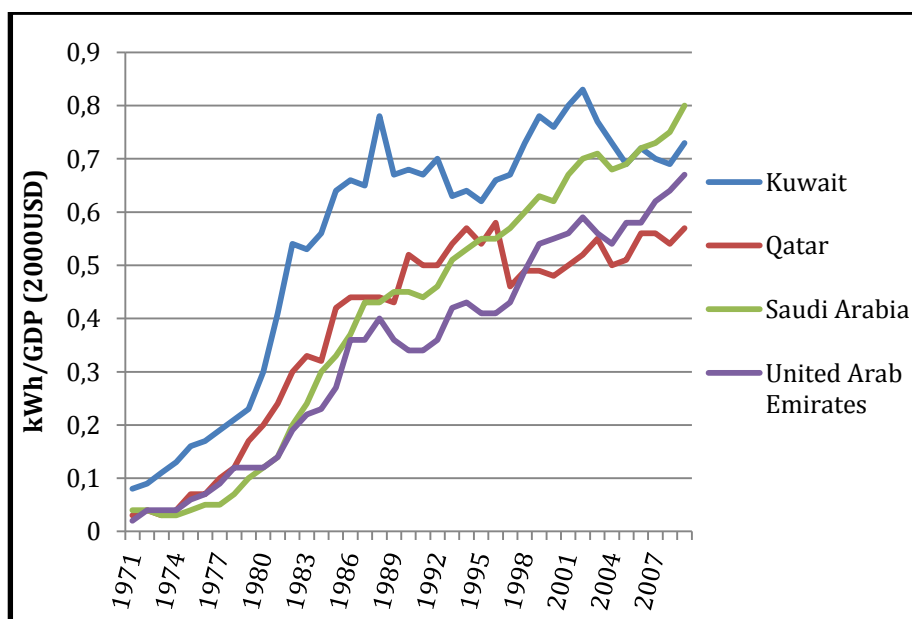
Source: World Bank Data 2011

The arid climate, petrochemical and heavy industry are partly responsible for the staggering rate of consumption. However, the energy efficiency of the economy, which expanded strongly with higher oil prices during the 1970s, has since stagnated or even decreased. The World Bank estimates that the energy consumption has increased more in the MENA region than in any other since the

1980s. Between 1990 and 2005, energy intensity was 60% above-the OECD average and 40% over the global average¹.

The energy intensity of the economy is the energy consumed to produce one point of GDP. In the Gulf countries in particular, graph 3 shows the dramatic increase in energy intensity of the economies, over the last 40 years². These countries have needed more energy to produce one point of GDP. This reflects to some extent the transformation of the economies and the expansion of energy intensive industries (heavy industries and petrochemicals) in the early 1980s, as well as short term fluctuations in oil prices.³ For instance, in 2008 the decrease in energy intensity was in fact due to very high oil prices which drove up government revenues.

Graph 3: The Evolution of Energy Intensity across selected GCC countries (1970-2009)



Source: IEA Data 2009

The current power capacity of the Gulf countries (70GW) is expected to triple in the next 25 years⁴. The Economist Intelligence Unit estimated in 2010 that power consumption would reach 662 TWh in 2020.

¹ ESMAP Energy Sector Management Programme Report 2009 quoted in Chatham House report, Burning Oil to Keep Cool: The Hidden Energy Crisis in Saudi Arabia, Glada Lahn and Paul Stevens, December 2011

² The curve on graph 3 is sensitive to the price of oil, explaining the improvements during the Iraq war or in 2008 when oil prices peaked again.

³ The energy efficiency of the economy is much more complex to evaluate. It consists of the ratio of the energy input on the energy output, and can mainly be assessed by sectors or products.

⁴ GCC: the backbone of Power Sector Reform, Hassan K. Al-Asaad available at www.gccia.com

- In Kuwait the ministry of electricity and water (MEW) estimates that it will need to double its power capacity from 14,000MW to 25,000MW by 2020.
- Saudi Arabia generation capacity is expected to double in the next ten years. KACARE (King Abdullah City for Atomic and Renewable Energy) forecasts an increase of power generation capacity from 50 GW today up to 80GW by 2032.⁵ On average, power consumption grew by 6.4% from 2000 to 2010, and by 9.7% from 2009 to 2010 according to ECRA, the kingdom's electricity regulator. The country is the larger power consumer in the region, yet its consumption per capita is lower than in the neighbor countries probably due to the milder climate in the North and South of the country and the lower urbanization rate. The country large water consumption rate (247.8l/day/capita) is mainly due to its agricultural sector.
- The UAE electricity consumption per capita is the largest across the Gulf countries. It grows at an approximate rate of 9% per year.⁶ The power consumption of the country increased five times since 1990. The UAE Power capacity, 20 569 MW in 2009, should double by 2020 to meet the demand.

This situation is not without consequences for the Gulf countries. On the one hand the cost of investment in power plants is estimated at \$ 100 billion over the next 15 years in the GCC by the Economic Intelligence Unit (2010). ECRA (Electricity Co-Generation Regulatory Authority i.e. the Kingdom's electricity regulator), estimates that Saudi Arabia will for instance need (SAR526 billion) \$150 billion to implement generation, transmission and distribution projects by 2020⁷. In Kuwait the MEW estimates that power and desalination projects for the next 5 years, to reach 22 400MW of installed capacity up from 11 200MW, will amount to \$15 billion. The

⁵ KACARE was created in 2010 by Royal Decree to manage renewable and nuclear development in the Kingdom. This forecast is extracted from a presentation made at the Solar Energy Forum in May 2012. The Kingdom 9th government plan (2010-2014) plans an increase of 20 400 MW by 2014 (source: National Commercial Bank, The Kingdom's Power Sector is Succeeding in Diversifying Sources of Funding to Meet Future Demand December 2011 available at www.alahli.com). This represents an increase from Saudi Arabia's 1995-2020 electrification plans which planned an increase to 67 GW by 2020. Consumption has grown faster than expected.

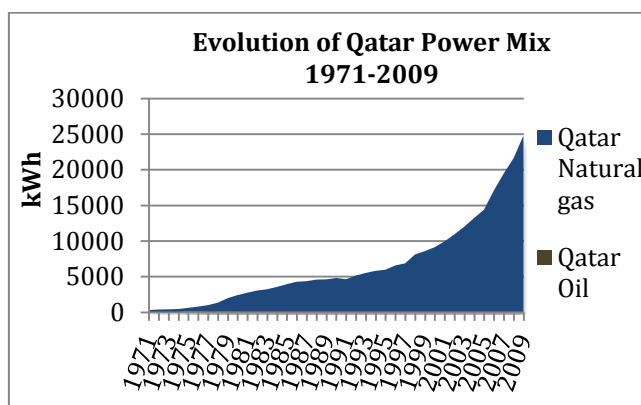
⁶ ENEC, the Emirates Nuclear Energy Corporation UAE

⁷ ECRA 2009 Annual Activity Report

need for additional water desalination capacity will also add to the bill.⁸

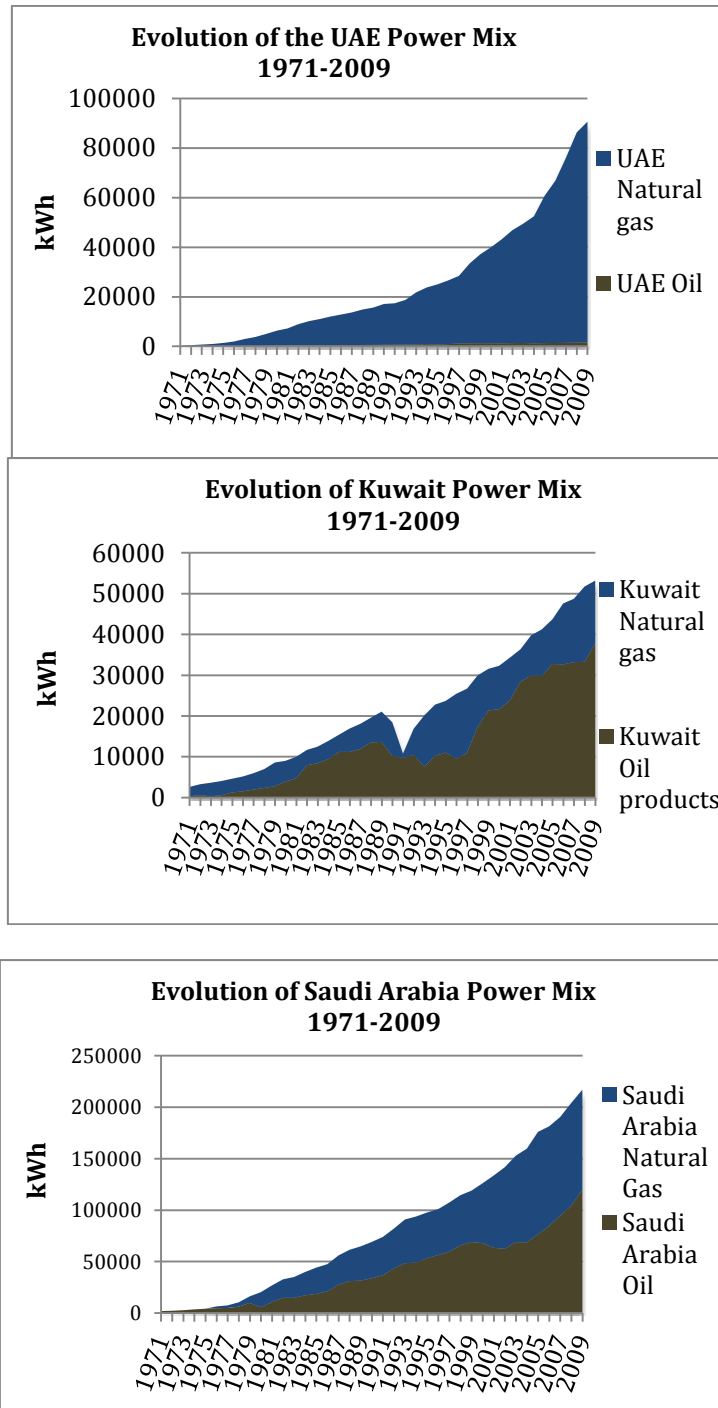
On the other hand the increase of power plants, i.e. the total installed capacity, does not increase as rapidly as peak demand. Therefore production margins have been reduced and the supply-demand balance has tightened: in June 2011, power consumption reached 99% of the installed capacity in Kuwait; Saudi Arabia peak load has increased by 7.7% per year over the last ten years while generation capacity has increased only by 6.7% resulting in a power generation margin of 7.6% (countries usually keep a spare capacity of 15%).⁹ The risk of power outages has increased. Lastly, some of the GCC countries, like Kuwait or Saudi Arabia, use a very large share of oil in their power mix; others are almost exclusively producing power out of gas, such as the UAE or Qatar. Graph 4 shows the evolution of the power mix of Qatar, UAE, Saudi Arabia and Kuwait.

Graph 4: the evolution of the power mix of selected Gulf Countries



⁸ In the UAE alone, the budget for water desalination increased from \$11.62 billion in 2007 to \$14 billion in 2008 (i.e. 20% in one year) source: Italian Trade Commission, March 2011 UAE Market report Water, Energy, Technology and Environment Exhibition (WETEX)

⁹ Maïté de Boncourt, Powering Kuwait into the 21st Century, IFRI Note, January 2012. If all planned capacity is built, amounting to 76 487 MW by 2015, Saudi Arabia should enjoy a power capacity margin of 15.4% by 2015 according to NCB (February 2011)



Source: IEA 2009

These fuels were initially preferred for power generation as they are cheap to produce in the region: oil cost around \$2-3 per barrel, and now around \$5-10 per barrel in Saudi Arabia. Moreover, these countries see energy security as a priority. Their people's health depends directly on their electricity production: air conditioning is a must in countries where temperatures can reach up to 50°C in summer and water supply depends on desalination plants which are

coupled with power generation. These countries are therefore reluctant to depend on imports to fuel their plants. This necessity explains the large share of oil still present in the electric mix of Kuwait or Saudi Arabia which have limited gas production relative to their needs. Gas shortages in the UAE, which have led to power outages, definitely acted as warning for these countries.

This policy orientation nevertheless entails impressive and growing costs. Oil for power plants is purchased at **production cost** (\$ 5-10); i.e. the breakeven price equal to the cost of extracting crude oil from the ground in Saudi Arabia; or at **budget breakeven price**, namely the price at which the states have to sell oil in order to fund their national spending in other states (\$50 in Kuwait and the UAE), but not the sale price on international markets (\$107.46 on average for the OPEC oil basket in 2011). The use of domestic resources of hydrocarbons, especially oil, for power generation has enabled the Gulf countries to maintain the competitiveness of their businesses. In other words, power generation benefiting from low oil prices, creates value. The question is whether oil has higher value in another economic activity (such as refining) or by using the benefits of export revenues.

So far, these energy producing countries have had excess capacity in oil and gas. Leaving the oil in the ground was therefore a greater economic loss than using it to generate electricity, even at a price which did not cover past investments. On the other hand, plants use fuel oil and heavy crude oil, two products which are priced lower than crude oil and which sell poorly in markets. The heating oil market has collapsed in particular due to stricter environmental constraints implemented in the countries of the OECD. The new refining technologies, and renovations and expansion of the sector in the GCC now allow these products to be transformed into other higher value products, such as naphtha, for example (see annex 1 on refining products). The expansion of the petrochemical sector in the Gulf provides greater value to fuel oil or heavy oil and sour. Volumes available are reduced, and prices increase. Similarly the gas associated with oil production, was hitherto considered a byproduct of oil.

In contrast, oil and gas production capacity margins are now smaller and new investments are needed to increase them. Some of the Gulf countries' fields are ageing and reaching the third, enhanced recovery e.g. for Kuwait's Greater Burgan or Saudi Arabia's Ghawar giant oil fields.¹⁰ Kuwait plans to develop heavy oil fields in the north. GCC countries are also facing the need to expand their gas production and invest into new technologies: Kuwait and Oman have plans to develop their sour gas fields; Saudi Arabia is speeding up its non-associated gas exploration and production; Qatar is developing

¹⁰ Enhanced Oil Recovery (EOR) is a method of Increasing fossil fuel production by injecting gas in the ground

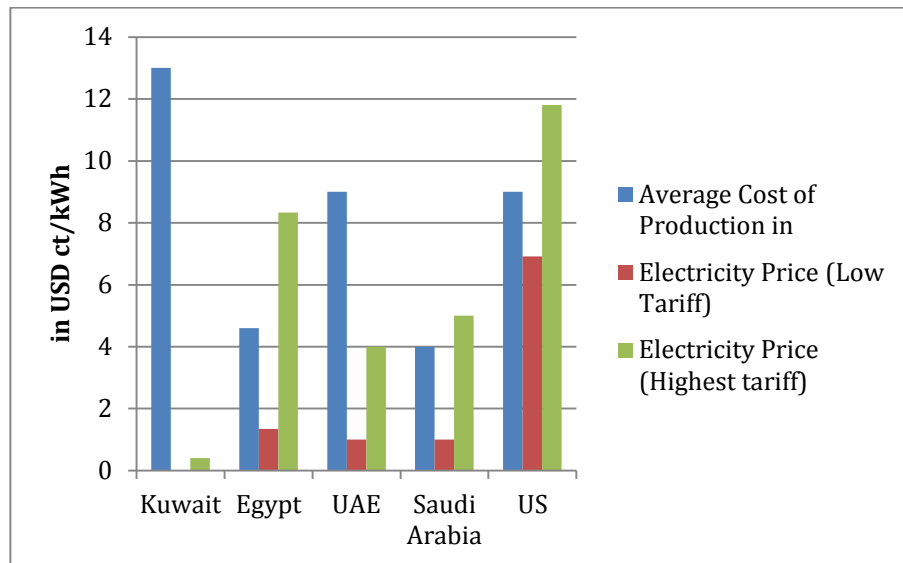
new technologies and has postponed the 2005 moratorium on North Field until 2014 to reassess the reserves and the impact of mass production. Oil and gas are increasingly valuable to other economic sectors, and international prices are rising, both contributing to enhance the cost opportunity of crude, fuel and heavy oil. It is therefore important to replace the direct cost of production (including or excluding investments) or the cost of budget balance by the opportunity cost of oil, i.e. the economic cost of a barrel of oil.¹¹

The electricity sector is subsidized in two ways in the Gulf. As already mentioned, the fuel burned in the power plants stations is not bought at global market prices. In Saudi Arabia, power plants buy their fuel at a price fixed by the government in a long term contract with Saudi Aramco (i.e. \$0.75/Mbtu for gas; between 5-10\$/barrel for oil products). In the UAE and Kuwait utilities buy their fuel at budget breakeven price (\$50/barrel). The fuel prices set for utilities do not reflect international market prices (up to \$17/Mbtu for gas, and around \$111/barrel for oil). Additionally, GCC states subsidize directly the price of electricity i.e. the price at which electricity is sold does not reflect the electricity production cost. To solve this problem, more or less detailed slide tariffs have been introduced in almost all countries.¹² Most of the time however the largest consumption shares are by the lowest tariff groups (i.e. households). This further narrows down the profit margins of the power industry, which in addition has to invest heavily to meet the growing demand.

¹¹ Luciani G., Nuclear Energy Developments in the Mediterranean and the Gulf, The International Spectator, Vol. 44, No. 1, March 2009, 113–129

¹² Saudi Arabia has three different types of tariffs (consumers (1), industries (2) and charities, mosques and agriculture (3)) and bracket tariffs. Generation costs include fuel costs. However in many countries, power plants buy their fuel at a subsidized price. Saudi power plants buy oil at \$5 to \$10 / barrel, in Kuwait and the UAE oil is bought at \$45-50 per barrel. ECRA does not state whether the price of electricity generation includes the price of oil, at market price. The graph gives therefore more an indication of the level of subvention than real prices.

Graph 5: electricity prices across the GCC countries



Source: Author's own compilation, Arab Union of Electricity Producers, UPDEA (Union Des Producteurs, Transporteurs et Distributeurs D'énergie Électrique d'Afrique), Saudi Arabia's Electricity Co-Generation Regulatory Authority ECRA
 *Production Prices in Saudi Arabia are based on subvention fuels for power plants

Low prices of fuels and electricity are a politically sensitive issue. They are considered by nationals as a natural right. The states use low prices to support the competitiveness of heavy industry or the petrochemical industry and the development of real estate. Low prices promote the outstanding development of these sectors in many GCC countries, notably Saudi Arabia, Qatar or the UAE. The extent to which these sectors really allow economic diversification and thus the sustainability of their economy is still debatable. These countries thus remain dependent on oil income. They directly depend on income from exports. Indirectly, their economic activities are in turn closely linked to their large hydrocarbon resources. Since power or fuel prices do not cover the cost of power generation on the one hand and the price of oil development in some cases on the other hand, these prices can be considered as subsidies and not only as prices reflecting these large natural resources.¹³

In Kuwait and Saudi Arabia, the burning large volumes of oil in power plants also has the negative effect of reducing these countries' ability to export. Saudi Arabia already burns about a fourth of its total oil production in its power and water sectors. Khalid Al-Fadih, Saudi Aramco president, estimates that on a business-as-usual trend around 8.3 mb/d of oil will be needed to satisfy power demand in

¹³ Upon accession to the WTO, Saudi Arabia argued that as producing country, it considers the long-producer marginal cost of oil and not international market prices as a global price maker for oil. There are indeed various subsidies in other forms in other countries (Chatham House report).

Saudi Arabia in 2028. Saudi Arabia's oil production capacity is 12.5 mb/d. Under these conditions, the world's second oil exporter will be unable to sustain its exports and its economy, with serious consequences for world oil prices. In Kuwait, according to a previous Ifri study the oil burned in the power sector could reach 22% of oil production by 2030, on a business-as-usual trend, if oil production remains constant, and 14% of the oil production if all projects to increase oil production are completed.

Oil production is restrained by OPEC quotas, and so is trimmed partly by increasing domestic consumption. The restriction on production (i.e. the quotas) set by OPEC for the GCC countries will tighten all the more so as Iraqi production gains importance. Iraq's reintegration into OPEC quotas would mean a reduction of other members' production quotas (quotas are based on reserves, and Iraqi reserves are large). Iraq oil production is planned to be reintroduced into OPEC quotas once it reaches 4mb/d. Today Iraqi production is 3 mb/d, more than pre-war production level. Iraq plans to produce 11mb/d by 2020. While the Iraqi production objective seems fairly ambitious, it is nevertheless threatening for the Gulf countries. The decrease of their export capacity would impact on the geopolitics of the Gulf countries. OPEC, the Gulf countries, and in particular Saudi Arabia benefit from their ability to influence global prices, which ensures their safety. Saudi Arabia for instance has been bearing the burden of oil shortages due to the Libyan crisis, and has increased its exports to alleviate the global financial crisis. Now, the arrival of new actors in the production of unconventional oil and discoveries of offshore oil and gas threatens the Middle East's dominance. Maintaining a large export capacity is even more important than before.

The problem is different in the UAE. The power consumption of the UAE, the highest consumption per capita in the region, is growing at the fastest rate of 9% per year. Unlike Kuwait the country has a large gas production (51.3 bcm against 11.7 bcm). The country therefore decided to keep its oil for export and use gas domestically through a low gas pricing strategy. Contrary to oil, gas selling prices are much lower than production prices. The electricity mix of the country is now almost exclusively gas fired (up to 98%). Given the electricity consumption growth, this strategy led however to other major issues problem, gas shortages. Since 2006 domestic gas demand exceeds production. In 2009 the country's gas production was 48.8 bcm; while consumption reached 59.1 bcm. The country exports also 7 bcm per year. The UAE therefore has to import gas. It imports about 18.61 bcm per year from Qatar through the Dolphin gas pipeline. The country has extensive reserves of gas, but they are mainly of associated gas and therefore subject to OPEC oil production quotas. On the other hand, the exploration of the country's non associated sour gas fields requires more advanced technologies,

and to date only one field was awarded to IOCs. Gas prices do not encourage the exploration and production of domestic gas either.¹⁴ This situation has caused gas shortages and consequently electricity blackouts in the Northern Emirates since 2007. Given the lack of gas, 75% of the electricity was generated with diesel in the Northern Emirates in 2008. The country faces a very similar challenge than Saudi Arabia and Kuwait: how to diversify its electric mix both to maintain exports of oil and gas, and to keep a feedstock for its refining projects so as to maintain states revenues.

The reduction in oil export volumes will in turn decrease the states' revenues. State budgets are already supporting extensive welfare systems and will face lower oil revenues, combined with increased spending for the installation of new electrical infrastructure (new power plants, extended power grids etc.), for energy subsidies, and investments to maintain the level of hydrocarbon production. With increasing electricity demand, low prices in the electricity sector are indeed increasingly unsustainable. According to the IEA, subsidies reached high levels of GDP, in particular in Saudi Arabia (up to 10%). Kuwait electricity subsidies are proportionally the highest in the region, and so is the level of subsidy per capita.

Table 1: IEA estimates of energy subsidies in selected Arab countries 2010

	Average Rate of Subsidization (%)	Subsidy (\$ per person)	Total Subsidy (% of GDP)	Subsidy by Fuel			Total Subsidy (US\$ bn)
				Oil	Gas	Electricity	
Saudi Arabia	75.80	1,586.60	9.80	30.5	0.00	12.95	43.52
Kuwait	85.50	2,798.60	5.80	2.81	0.90	3.91	7.62
Qatar	75.30	2,446.00	3.20	1.15	1.41	1.59	4.15
UAE	67.80	2,489.60	6.00	2.65	9.99	5.51	18.15

Source: IAE 2010

An imbalance in the budget of the Gulf States would have a dramatic impact on the economy. Indeed, export revenues are an important part of state budgets.

¹⁴ The domestic gas price is US\$ 0.75/Mmbtu (Darjin 2008). Gas is purchased for \$ 1.5/Mbtu from Qatar. Compared to international LNG prices \$17/Mbtu in Japan.

- In Kuwait, oil exports revenues amounted to 61.4% of the GDP and 81.6% of the state budget in 2009; they are expected to have reached 91.6% of the state budget in 2010/2011¹⁵.
- Saudi Arabia relies on the oil sector for 80% of public revenues, 45% of GDP, and 90% of export earnings.¹⁶
- In the UAE, oil and gas exports revenues amounted to 74.7% of the state budget in 2010, and oil and gas exports amounted to 36.98% of the GDP in 2008 (25% in 2009). This share is decreasing as the country relies increasingly on gas imports.

This budget is necessary to maintain large welfare benefits and maintain jobs. The size of the public sector has actually increased in recent years despite attempts to develop the private sector in most Gulf Monarchies. The social consequences could be disastrous. The soaring costs resulted in a displacement of the point breakeven price for oil in most states: in February 2011 the breakeven price for oil in Saudi Arabia reached \$82/barrel up from \$72/barrel in 2010 and \$67/barrel in 2009. By 2050, on a Business as Usual Scenario the breakeven of oil would be \$100-200.¹⁷

The oil monarchies of the Persian Gulf must face the explosion of their internal energy internal energy consumption. This unsustainable situation could have disastrous consequences for their economies, and for global supplies. The electricity sector is an important key in this energy paradigm.

Based on this first chapter, the following conclusions can be made:

- GCC countries need to maintain their hydrocarbon revenues by curbing domestic consumption of oil and gas
- This could be achieved through a diversification strategy to reduce oil consumption in the power sector, or through the implementation of energy efficiency measures to reduce power consumption per capita.
- The financial burden on the states is growing along with the need for additional power capacity.

¹⁵ IMF International Monetary Fund

¹⁶ UNDP 2005 available at:

http://www.undp.org.sa/sa/documents/home/cpd_2012.pdf

¹⁷ Interview with Saudi Official

Therefore they are looking at ways to attract private investors.

- To maintain their economic stability, they would need to engage further into diversification to build up non-oil growth.
- The pricing of fuel for the power sector is important. By mixing three different oil and gas costs (i.e. extraction cost, budget breakeven cost and development cost), GCC states and governments can hardly clearly evaluate the total costs and benefits of the options chosen. These are arbitrary values instead of real values. There is as a result little room for economic rationality.

There are however significant differences in the region. The energy context and the power sector's structure vary from state to state. The policy responses are not uniform either. The sense of urgency is not the same everywhere and these states have different political and institutional systems. Broadly, the Gulf countries have opted for the diversification of their electricity mix, and the development of alternative energies as they devise ways to diversify their economies. Structural reforms of their power sectors are also being undertaken, so as to attract investment. The following chapter explains the rationale behind policy options, i.e. the liberalization and privatization of the power sector, along with the diversification of the power mix. It analyses the institutional setting and the actors driving policy reforms, and concludes with the difficulties encountered by each country, their ability to pursue reform and elaborate an integrated vision.

Power Sector Reforms across the Gcc

This chapter discusses power sector reforms mostly in three Gulf countries. Saudi Arabia and Kuwait have been chosen for their significant resources in oil and the power mix which was similar in the 1990s, but which has evolved differently since then. And, the UAE are chosen as they had to cope very early with a decrease of their hydrocarbon production and are now pioneers in power sector reform, like Oman. Qatar is a special case because of its huge gas resources, and its consequently exclusive gas power mix. The reforms in this country are not very advanced yet. It is therefore a less interesting case to study.

The following points will be addressed for each country, so as to assess its ability to tackle the energy paradigm mentioned in the first chapter and to understand the reform processes going on:

- The power sector structure, regulatory developments and liberalization process at different speeds.
- Is the diversification plan of the power sector on time?
- Is the institutional setting supportive?
- Are needs anticipated and does an integrated vision exist?

The last part will address the prospects for creation of a regional market (the so called GCC grid).

Regulatory Developments in the Power Sector

The liberalization of electricity market is the move from a vertically integrated utility owned by the government (national, regional or local) which has the obligation to deliver electricity (and water in the case of the Gulf countries) to a another economic model. The process known as unbundling consists of opening one or more segments of the next generation, transmission, distribution) to private capital, domestic and foreign, and technologies associated with it.

The electricity market liberalization stages (described in more details in Annex 5) are the following:

- first, a single buyer is created to allow competition in the electric generation,
- then all power plants are given open access to transmission so that they can transport their electricity to distributors or large customers (factories, plants),
- Finally a wholesale market is created.

These steps are described in Annex 5. As up today most GCC countries have embarked on the privatization of their power sector. Liberalization though progresses at different speeds.

The creation of electricity markets is thought to reduce pressures on state budgets through the use of private capital. The full sector liberalization reduces the costs imposed on the state budget by the growing power consumption (as mentioned in the first chapter). In theory, the competitiveness of the market encourages the lowest power generation cost, and thus power plants are using as little fuel as possible. Plants are called according to their order of merit¹⁸, from the cheapest to run to the most expensive, optimizing hereof the utilization of the system. This allows alternative technologies (nuclear, renewable in particular decentralized renewable) to be developed. GCC countries have from this perspective opted for the liberalization of electricity markets, at different stages according to the country considered. They wish hereby to encourage innovation and a better adaptation to new technologies.

Most Gulf countries have opted for the introduction of Independent Power Producers (IPPs) or Independent Water and Power Producers (IWPPs), which can be considered the first step of market privatization. IPPs or IWPPs relieve the governments from operational cost. As private actors bid on LCOE, these power plants are usually cheaper to build, operate and maintain. Under this type of contract, the government, or its delegate, decides to build a power plant, defines its specificities and then invites the private sector into a bidding process for the financing, the building and the operation of the plant. Electricity generated by the plant is then bought by the government through a Power Purchase Agreement (or Power and Water Purchase Agreement), at a fixed price or through FiTS. These contracts are generally long-term contracts (20-25 years). Additionally, the price of fuel can be fixed in the contract, or in the

¹⁸ Power capacity is organized in different categories of base-load, mid-load and peak-load. Power plants are called according to a merit of order: the cheapest plant to operate is called first to cover the base-load, more flexible plants are then used to cover the mid and peak load

case of GCC states, it is provided by the government.¹⁹ The bids are based on the Levelized Cost of Electricity (LCOE) (including fuel consumption), and the timing of the project is also defined. This stage is relatively simple. Moving to wholesale or retail competition stages where producers and distributors compete is much more complex and long to introduce in countries which are not yet fully internally interconnected.

The length and the political difficulties encountered to undertake structural reforms, including the introduction of pricing schemes reflect real costs, and the willingness of Gulf countries to keep their grip on power mix to maintain their energy independence, has often led the GCC to start and sometimes stop at the stage of the IPPs model. IPPs and IWPPs alleviate the burden on the state's finances, and serve as tools to diversify the power mix quickly. Long-term IPPs may however inhibit the transition to privatization because of the length of contracts (20-25 years), which could constrain the future market design if no buy-back mechanism included in the contract.²⁰ Last but not least, the high debt ratio of IPPs makes them very sensitive to credit tightening and conditions in financial markets.

There are pitfalls to the liberalization of the electricity sector. Indeed, the market favors low costs of production. The more a power plant produces, the more it is profitable. Consequently, generators tend to concentrate on basic and mid-load in a market where consumer prices are regulated (where prices cannot rise with the peak load). This in turn would be detrimental to the diversification. This could be especially true in the GCC countries or where governments deliver oil or gas at low prices.

Europe, and the different national power mixes are a good case study for the establishment of an electricity market. For example in France, market liberalization is occurring at the expense of peak load capacity. Indeed, regulated prices do not encourage generators to invest in power plants that are not used enough to be profitable. In addition, grants and priority access granted to specific power generation technologies (such as CHP or renewables) have prevented the market from functioning properly. In Germany, the problems are aggravated by the large and unorganized deployment of renewables. Renewables will represent up to 70% of the total generation capacity by 2030. Renewables have priority access to the grid (as they are subsidized), and are therefore not playing by market

¹⁹ This reduces market and fuel risk. Investors can therefore raise significant funds with an average debt ratio of 75%, which can reach up 85%. The costs are divided into fixed costs: development costs, capital Investments, fixed operating and maintenance costs, and the costs of capital; and variable costs: the costs of operation and maintenance, as well as the fuel or (energy cost – see Booz & Co.)

²⁰ IPPs may also prove costly to government bound to buy a given volume of power if electricity consumption slows down, and it blocks a portion of their assets into long term contracts. (Source: Booz & Co. The Future of IPPs in the Gulf Countries, March 2010)

rules. RES power has to be used whenever it is produced. Other power suppliers have therefore no visibility over which plants are called into production, at what price and where. Therefore they cannot assess whether the operation and generation of their power plants will allow them to recover from investment cost. Renewables are a substantial factor of uncertainty.

The support given to renewables, which are an intermittent means of power generation, requires the introduction of measures of flexibility in electricity demand as well as reinforced grid interconnections between states, so as to allow for the better dispatching of production. Grants (awarded to support renewables in the case of Europe, or through low fuel prices across the GCC) jeopardize the theoretical model of liberalization and the resulting benefits. Similarly, the introduction of IPPs or IWPPs should be done as part of a plan that integrates the different objectives and market externalities.

Diversification of the power mix

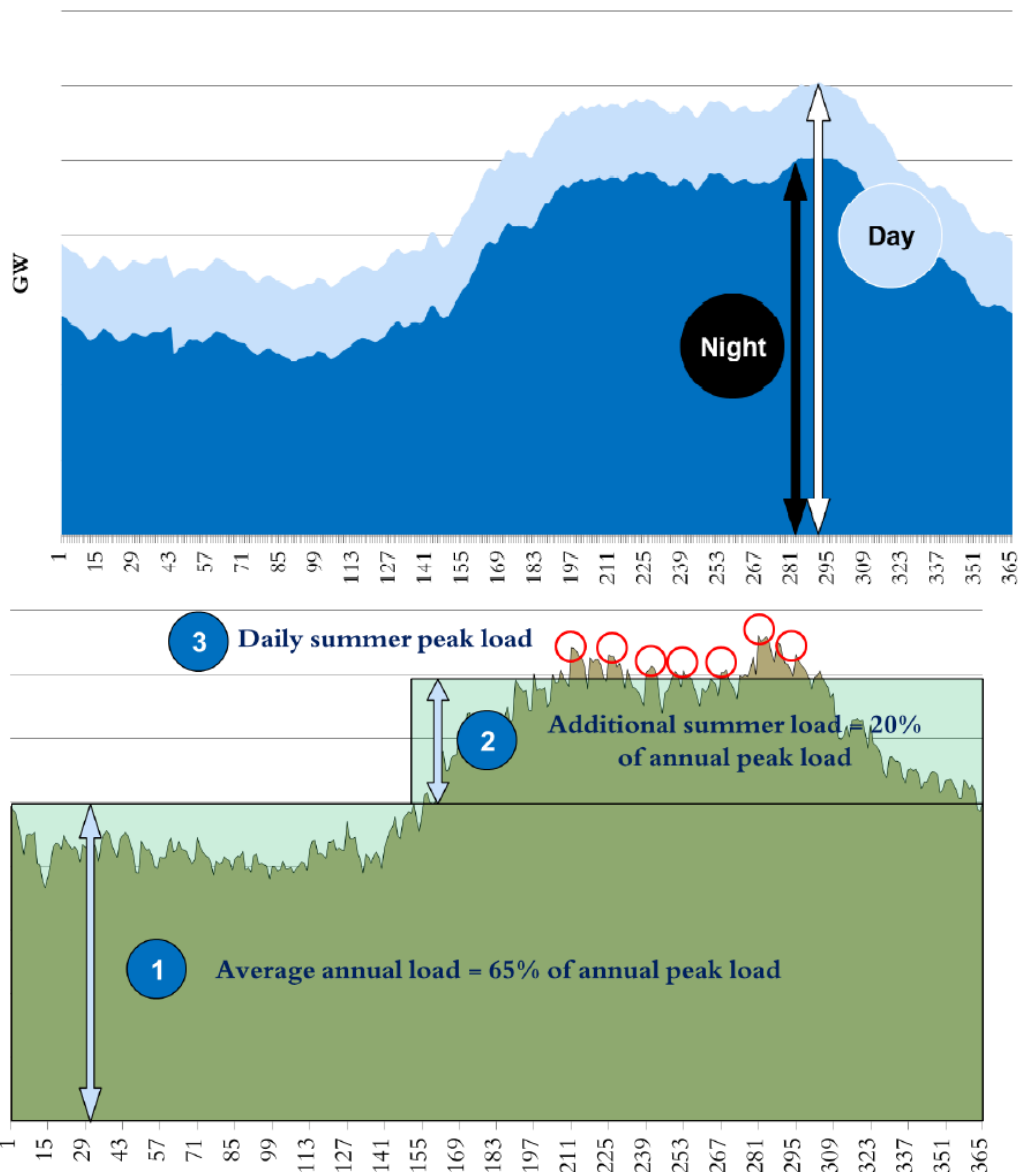
Persian Gulf states can also decrease their internal fuel consumption, unsustainable for their economies, by diversifying their power mix. The UAE and Qatar have mostly gas power mixes. Saudi Arabia and Kuwait are switching their power mix to gas as well, as it allows them to maintain their oil export capacity. In the former, gas will however be used primarily as a feedstock for refining. Kuwait on the other hand has fewer gas resources. This strategy is however confronted to regional gas shortages (see annex4). This point will be developed in the dedicated chapters.

Renewable: real policies or green branding?

There are significant renewable energy resources in the GCC, now dubbed the new "sun belt". As shown in Table 2, solar radiations are among the highest in the world. Unlike Europe, the Persian Gulf's sunshine and windy hours are stable and take place during peak hours. Indeed peak demand occurs during the warmest hours of the day (and therefore also the sunniest) due to air conditioning. PV or CSP power generation could therefore be easily integrated in the power mix (and the merit of order) to act as peak shaving (see graph 6 below). As there are large differences between summer and winter, and large peak demand during the day in summer, peak shaving would help to save a lot of power capacity. In Kuwait, the peak is around 1080h per year (5 to 7 days) and requires huge investments. Kuwait and Saudi Arabia in particular have a high potential for CSP

(which relies on DNI Direct Normal Radiation) and a good potential for wind energy²¹.

Graph 6: Saudi Arabia's annual electricity load curves



Source: KACARE May 2012 Solar Energy Forum

These curves are representative of GCC power day versus night and annual load patterns.

Many studies show that the operating cost of solar energy (PV in particular) is already competitive with electricity production from oil.

²¹ For more details on the available renewable technologies and their cost in the GCC please refer to Maité de Boncourt, Powering Kuwait into the 21st century : Alternatives for Power Generation, IFRI Note, May 2012 available at www.ifri.org

The IEA considers that both utility scale PV (with the same building cost than in Germany) and CSP are competitive with oil fired generation when oil prices are at \$80/barrel.²² At the opportunity cost of oil (i.e. around \$110-120), solar power plants are therefore competitive with steam power plants.

Table 2: Solar radiation in the GCC countries

	Global Solar Radiation (kWh/m ² /day)	Direct Normal Solar Radiation (kWh/m ² /day)
Bahrain	6.4	6.5
Kuwait	6.2	6.5
Oman	5.1	6.2
Qatar	5.5	5.6
Saudi Arabia	7.0	6.5
UAE	6.5	6.0
Germany* (50% of the installed PV capacity worldwide)	2.7	2.6
USA California*	4.7	5.1

DNI for CSP to be viable is around 6 kWh/m²/day
0.2% of land GCC (625 000 km²) needed to fullfull 60 GW in 2003 assuming a CSP efficiency of 20%

*Source KISR 2010

Source: extracted from IRENA presentation May 2011 Rabia Ferroukhi

Table 3: Wind resources in GCC countries

	Hours of full load of wind per year	Capacity Factor %
Bahrain	1360	15.5
Kuwait	1605	18.3
Oman	1463	16.7
UAE	1176	16.2
Qatar	1421	20.4
Saudi Arabia	1789	13.3

1400h full load for wind to be economically viable.

Source: extracted from IRENA presentation May 2011 Rabia Ferroukhi

Renewable are also seen by the Gulf Monarchies as a way to diversify the economy, develop a new industrial sector and provide jobs for their population.

²² International Energy Agency, Solar Perspectives, 2011

The success of renewable policies in the GCC will depend on the government abilities to define a clear legislative framework regulating grid access, establishing clear PPAs or FiTs (feed-in-tariffs), and easy permit procedures. On the technical level, grid capacity and system constraints should be considered. Finally, if they are willing to develop renewables, also as a way to diversify their economies, governments have to address human capital barriers and technology barriers. The scope of projects developed, money invested but mainly progress of legislative frameworks and of market regulation tools are good indicators to determine a country's level of commitment to renewable.

The main competitors however remain the subsidized price of fuel and electricity. In this context, the renewables will hardly be profitable. Yet, while most GCC countries have ambitious RES target and development plans, most of them are still struggling to reform prices.

Nuclear: still on the menu

Some of the Gulf countries, like the Emirates or Saudi Arabia, have plans to develop nuclear power. The development model is based on strong global integration and the reliance on external sources of technology. The policy frameworks are being drafted with the help of the IAEA. The Fukushima disaster has however led some countries like Kuwait to review their nuclear stance. So far nuclear energy has been viewed as an interesting option for an integrated regional market, especially for small countries.

Energy Efficiency: an unexploited resource

Efficiency is another dimension of the energy question. This part will analyze the different countries' policies in the sector. Many technologies exist to reduce demand from buildings (building codes, new district cooling technologies), and market liberalization could indirectly enhance power generation efficiency. Wasteful consumption habits are also driven by low prices, another field for energy efficiency.

The role of institutions in the reform process

In the region, most governments have used their tax revenues and budget surpluses (due to high oil prices) to intensify their institutional activity. States have indeed returned to large scale project funding and experimenting new types of institutions, more independent from the state and less subject to political interference and administrative intervention. New institutional practices are emerging as part of the liberalization process. The ability of the GCC states to create the

adequate institutional setting to support their energy transition nevertheless depends on their political systems.

Case Study 1 - Saudi Arabia

Saudi Arabia faces major challenges. The country is the world's second largest oil producer and has the largest world oil reserves, as well as having the 7th largest gas reserves. Population growth has created significant needs for water and electricity, to which the needs of the petrochemical and heavy industries, developed since the 1970s, must be added. As shown in the first chapter, the power sector consumes nearly a quarter of Saudi oil production, though subject to OPEC quotas. The main risk for Saudi Arabia however is not the depletion of its oil resources, but the loss of its production capacity margin. The country has a substantial production capacity margin, allowing it to increase production rapidly, so as to modulate oil prices. Saudi Arabia also benefits of agreements with third parties to ensure its own security, a major concern in the view of the Iranian crisis. The country has therefore a strong interest in maintaining reasonable prices for oil and to maintain its production capacity margin. Saudi Arabia has consequently launched an ambitious reform program targeting the power and the water desalination sector.

Of the fuel consumed domestically (see Chapter 1), 40% is consumed by the power and water sector, and 20% by transport. The country has the largest population across the GCC. Most of the power generated is consumed by households; around 70% of the peak demand is driven by air conditioning.²³ The country has a population of 27 million, of which 18 million are Saudi citizens. In the coming years, the multiplication of households will be tremendous. The Kingdom will have to provide them with water, power but also with jobs. Saudi Arabia has therefore started to develop its economy with heavy industry, but the local market for power is also considered as an opportunity for economic development and diversification.

Saudi Arabia's power sector structure

The Saudi electricity sector is structured around the Saudi Electricity Company (SEC). 74.3% of this quasi-governmental body is owned by the government, 6.9% by Saudi Aramco, while 18.8% of shares are traded on the Saudi Stock Exchange. The SEC owns and operates 71 power plants, accounting for about 80% of the electricity capacity

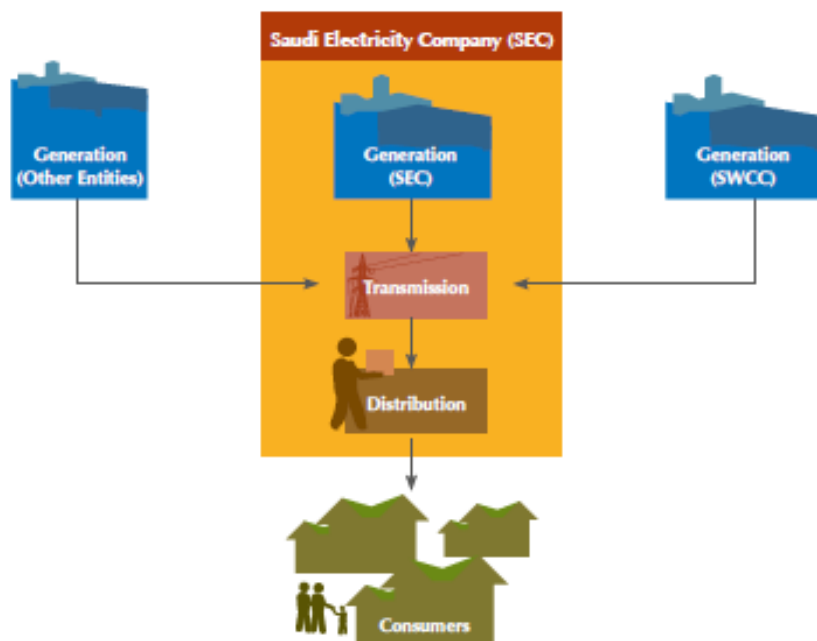
²³ Interview KASCT

of the country.²⁴ Electricity tariffs are regulated by the state according to a sliding scale.

The desalination sector is structured around the SWCC (Saline Water Conversion Corporation). The SWCC belongs to the government, and produces both water and electricity (3,426MW, of which 2,059MW are bought by the SEC). The price of water is regulated by the Council of Minister's Resolution.

Following the privatization process, 80% of power is now generated by SEC, 10% by SWPP and 10% by Marafiq.

Graph 7: Saudi Power Sector Structure



Source: ECRA 2009 Annual Report

The most ambitious liberalization plan across the Gulf Countries – stalled?

In 2000, the Saudi Electricity Company was created by Royal Decree, after the merger of 10 regional companies. The SEC is pivotal in Saudi's power sector and its creation marks the start of the liberalization process. It is also the result of an ambition to create a large utility at the regional level. Saudi Arabia has a strong interest in regional integration and Saudi Arabia's reforms are made in the

²⁴ SEC owns 40,697MW out of 49,138MW.

framework of the liberalization process advocated by the GCCA. On the other hand, the country expects to attract private investment to finance its growing power capacity needs.

Saudi Arabia has taken steps towards privatization. In 2001 ECRA, the Electricity Service Regulatory Authority was established to pursue a market liberalization plan. In 2002, the supreme economic council passed a resolution to allow private sector participation in IPPs or IWPPs, so as to attract private investors into the power sector.²⁵ A single buyer was therefore created in 2003, the Water and Electricity Company (WEC), in partnership between the SEC and the SWCC. The single buyer purchases all the water and electricity produced by the IPPs and IWPPs, and resells them to the SEC and the SWCC, which are in charge respectively of the power transmission and water distribution systems. A joint stock company, Marafiq, was also created by the Council of Ministers for the industrial cities of Jubail and Yanbu. In the western province, the Water and Power Corporation was created. Several IPPs are being built for a total capacity of 8,456 MW by 2014, according to the Saudi National Commercial Bank NCB, and private production started in 2007.

The three stage plan restructuring the power sector towards servicing a competitive retail market by 2016 is the most ambitious plan throughout the GCC:

- The unbundling and competition generation stage 2008-2010: the SEC will be unbundled into separate generation, transmission and distribution companies. Competition is introduced into the generation, partly through IPPs. The SEC assets are divided into four generation companies, as well as a power procurement company to act as a single buyer, and a grid company that will own the transmission system and act as an independent system operator.
- 2010-2013: the wholesale competition stage. This involves increasing the size of the parallel market, the creation of distribution companies owned by SEC, the establishment of a spot market allowing non-discriminatory access by large electricity customers to the grid and implementation a wheeling tariff set by ECRA.
- 2013-2016: retail competition. The full wholesale market is operated by an independent

²⁵ The IPPs or IWPPs are 60%-owned by the developer, the rest is split between SEC and the Saudi Government's Public Investment Fund (PIF). IPPs are concluded for 20 years. The SEC acts as a single buyer, and the private owner benefits from a fuel supply agreement. The IPPs' tendering processes have attracted an increasing amount of bidders: there were two bids in the first IPP round, and six bids in the third IPP round in March 2011. The Minimum debt share 70-80%.

system operator. Both the generation and the distribution companies have an independent role in the market. The single buyer has a restricted role.

So far, the SEC actually still has a quasi-monopoly over the generation and still a monopoly over distribution and transmission. The privatization has indeed been delayed. The lack of interconnection between the different regional systems, with the exception of the eastern and central province, also acts as a bottleneck. In 2010, ECRA proposed the plan to unbundle the SEC. Generation will be divided into 4 portfolios, but transmission and distribution will remain a monopoly until the government decides otherwise.

Diversifying the power mix from gas to renewable and nuclear – on time?

Saudi Arabia has started to switch its power fuel mix to gas. The country disposes of the world's fourth largest gas reserves. However, most of the gas is in the form of associated gas (60% of the country's proven reserves) thus directly depending on oil production which is regulated by OPEC quotas. Additionally, other industries are gas oriented. Gas is also used as a feedstock for the Saudi petrochemical sector, keen to maintain its access to a low price resource so as to keep its competitive advantage. The tendency is also to use gas to maximize oil output capacity, through enhanced recovery processes as oil fields are ageing. The non-associated gas reserves (10 Tcf reserves) are more difficult to produce, and only 25% of them are free from sulfur and easily recoverable. The country has therefore opened its exploration and production sector to foreign investments and technologies. However, the allocation of 4 zones of exploration to IOCs has failed to prove successful. Offshore fields offer some prospects.²⁶ Saudi Aramco has designed a multi-billion dollar strategy to boost natural gas processing capacity from 9.3 bcf to 12.3 bcf.²⁷ The country has therefore placed a moratorium on gas exports until 2030. At the same time, Saudi Arabia is reluctant to import gas, due to the high cost and concerns about import disruptions as well as geopolitical considerations.

As a result, gas shortages have prompted oil substitution. Saudi Arabia's power mix has therefore still a large share of oil. In 2010, SEC consumed 40% of crude oil, 34% of gas, 4% of heavy fuel and 22% diesel. Most of the expansion plans for 2012-2016 will be steam fired (around 17,400MW of new capacity).

²⁶ For gas production prospects please refer to a previous Ifri study: *Powering Kuwait into the 21st Century, Alternative Sources*.

²⁷ Wharton

The Kingdom is therefore looking at other alternatives. It is drafting a highly promising renewables plan for the short term, and hopes for the development of nuclear power by 2020. At the heart of this strategy, lies KACARE. The King created KACARE (King Abdullah City for Atomic and Renewable Energy) in 2010 by Royal Order with two objectives: to develop nuclear power and renewable energies to meet the country's demand and contribute to sustainable development and economic diversification.

A promising renewable strategy

The Kingdom's interest in renewables dates back to the 1960s, when oil prices were low. In its second five-year plan (1975-1980), the country committed itself in numerous projects including SOLERAS (Solar Energy Research American Saudi): 150 projects have been developed in universities and research centers, as well as a PV project in selected villages, and for the protection of pipeline corrosion. These projects have helped in particular to collect data.

The new strategy announced recently in May 2012 had the impact of a bombshell: the capacities announced are huge, the budget significant, the regulatory framework is already designed and the timeline is set. Among other things, the country plans the installation of 54.1 GW of renewable by 2030: 41 GW of solar capacity including 16GW of PV and 25 GW of CSP; 1.7 GW of wind capacity; and 450 MW of other renewables such as geothermal power and energy from waste. Three bidding rounds are planned in 2012, 2013 and 2014, and feed-in-tariffs shall be introduced thereafter (i.e. by 2014). Large scale projects are favored (a minimum of 5GW), and the contracts are Power Purchase Agreements. The Sustainable Energy Procurement Company (SEPC) will be created to act as a contract counterpart and manage the administration of nuclear contracts. This government body will be operated in a corporatized manner. With such a strategy, solar energy should provide up to 30% of the Kingdom's electricity by 2032, according to Dr. Waleed Abulfaraj (vice-president of KACARE talking at the Saudi Solar Forum 2012). This is much more than the 15% initially considered, and it will cover the additional summer peak load which represents 20% of Saudi Annual peak load.

The development of renewable energy, and solar power in particular, is viewed as a way to diversify the economy. The bidding process includes a "national component" as a criterion. In March 2011, the government already announced the *National Industrial Clusters Development Programme*, which consists of the creation of three local and regional separate polysilicon plants, with a total capacity of 20,000 tonnes per year; and a feasibility study for the

construction of a film solar module plant, with an initial capacity of 200MW per year; and lastly of a joint venture with international manufacturing of solar inverters.²⁸

The plan presented by KACARE is still subject to the government approval. The country has nevertheless already started several solar projects listed in Annex 2, and is entering the production phase. In particular, Saudi Arabia has focused on desalination, which represents around 30% of power consumption. In January 2010, KACST (King Abdullah City for Science and Technology) started a three stage initiative: a first solar desalination plant will open in 2012/2013, to provide 30,000 m³ for the city of Al-Khafji (close to the neutral zone with Kuwait). It will supply 100,000 inhabitants. The objective is to reach 300,000 m³ per day, three years after the start. By 2030, all desalination should be covered by solar power. After nine years (by 2020), all new desalination plants will use solar technologies.

Nuclear development

In June 2011, the ministry of Commerce and Industry Abdullah Zainal announced the spending of \$100 billion to develop nuclear power plant capacity. According to KACARE, which is responsible for the country's power mix diversification, the plan is to build 17 GW of nuclear capacity by 2032 (up to 60 reactors). The first plant should come online by 2020. The country already started the nuclear industrial authority process. The radiation aspects are well advanced and 80% of the policy framework has been approved so far.²⁹ Saudi Arabia was a key player of the 2006 GCC joint program in nuclear technology.

This technology is not brand new for the country which created an Atomic Energy Research Institute AERI inside KASCT in 1988. The development of this technology will however be made in partnership with foreign companies. Saudi Arabia has signed memorandum of understanding with the US in 2008, cooperation agreement France, Argentina, South Korea and more recently China. Exelon, Toshiba Shaw Group, has offered their cooperation for a Joint venture. Issues of safety seem well advanced according to a KACARE official. The model followed is the one of the UAE, i.e. certification by the vender. Regarding security however, the regional context fueled with Iran claims to develop nuclear weapons is tense. Saudi Arabia will develop its nuclear power program as part of the

²⁸ Source: MEED Insight.

²⁹ To draft nuclear and renewable policies, KACARE has contracted a finish consultancy (Poyry) to draft a national vision for nuclear, the UK PWC should develop the regulatory aspects, Roland Berger should assist the Kingdom for an investment strategy and Vinson & Elkins and Morgan Lewis and Bockius will assist KACARE on legal advice. Source : MEED Insight

GCC 2006 joint program which cooperates with the AIEA. The Iranian threat is however not negligible. In December 2011, the Prince Turki, Ambassador in the US, declared to the press that the country could envisage the development of nuclear weaponry for defense purposes.³⁰ The signing of a cooperation agreement for the development of peaceful nuclear with China is also interesting from a geopolitical perspective. The two countries bilateral trade is growing every year, as China becomes one of the main importers of hydrocarbons. China is also refusing to ban Iranian exports, as it benefits from oil and gas exports.

Nuclear power will therefore allow Saudi Arabia to reduce some of the burden on its oil and gas production. However, the time frame is long. Nuclear power plants generally take around eight to ten years to build. The first reactor could, on an ambitious schedule, be ready by 2020-2022, but the tendering process has still not been launched by the government. Yet Saudi Arabia has surely the capacity to develop projects rapidly. The country can also develop gas to a certain extent. Yet, the transition from 2020 to 2030 – when demand is set to grow tremendously – will hardly be covered by nuclear power plants. Additionally, the Saudi Arabia power sector is linked to desalination. Parallel to the development of its nuclear capacity the country will have to build additional desalination capacity.

The adding of new capacity and in particular nuclear and renewable power capacity will require an electricity grid capable of coping with a substantial load from nuclear power plants or intermittent production. But, Saudi Arabia is divided into regional grids which are not all connected so far: the eastern and central regions are well connected and the central and western regions should be connected by 2013. The SEC has already budgeted the new grid interconnection. The cost of the grid requirements amounts 15-18% of newly added generation capacity. The plant and project tenders do not account for grid load capacity; the government will have to support this financial burden.

Saudi Arabia: Energy Efficiency

The country also needs to meet the rapidly growing power demand through efficient and rational consumption patterns. The renewal of the park, as well the management by private actors concerned by production costs, will increase the energy efficiency of power plants. 50% of power demand comes from households. Air conditioning alone contributes to up to 70%-80% of total electricity consumption in the summer months. Efficiency measures for buildings should be a priority.

³⁰ New York Times, December 2011

The government decided the creation of the Centre for Energy Efficiency hosted by KACST (King Abdullah City for Sciences and Technology). National energy efficiency measures have also been supported by the UNDP's National Energy Efficiency Programme. Since 2003, the UNDP has partnered with the King Abdul-Aziz City for Science and Technology and lead private sector partners such as Saudi Aramco and the Saudi Basic Industries Corporation (SABIC), in order to increase demand side energy efficiencies in key sectors of the national economy.³¹

So far energy efficiency has focused on the green labeling of consumer goods. Saudi Arabia has adopted the US LEED certification. This applies also to air conditioning. Yet there are so far few results regarding buildings. The country has decided on a voluntary building code. The code initially targeted the new governmental housing program (such as the \$67 billion package in 2011, for the construction 500,000 housing units) and thermal insulation. This code is now binding and applies to all buildings, but implementation is lacking. The Center is administrated by up to 19 agencies and headed by KASCT president. The Energy Efficiency Center is willing to coordinate them, but so far it has had little room for maneuver to enforce policies, and is consequently now mainly focusing on product labeling.

With large housing schemes increasing values in the Saudi property market, greening the building sector should be made a more serious priority. In February 2011, Abdullah bin Abdul Rahman Al-Hussein, the Minister of Water and Electricity declared that power consumption will have to be reduced by 40%, thanks to energy efficiency measures in buildings and desalination. But he did not specify the timing or any detailed measures. A new policy framework should be published by 2013.

In the end, for green construction to take roots, significant changes to the culture of energy subsidies still need to be addressed. Until then, there is little interest for companies or households to pay attention to their energy consumption or invest in green buildings. Subsidies hamper the pay-back of greater efficiency.

Moreover, power prices are so low that they encourage the waste of electricity and natural resources. In 2010, the government increased power tariffs by 9.6% for companies and administrations, The new price still does not however reflect production cost, and tariffs for households remain unchanged, though the latter consume half of the power generated.

³¹ UNDP's National Energy Efficiency Programme (NEEP) supports energy auditing in industrial and commercial sectors, utility load management, setting policies and regulations for residential buildings and energy-consuming efficiency in appliances, improving information exchanges for energy efficiency, promoting energy services and private sector investments and the use of clean energy technologies (source: UNDP)

Saudi Arabia: Institutional Actors

The reform process in Saudi Arabia benefits from a dynamic set of actors: a well-developed university base, a dynamic private sector, and the creation of agencies under patronage of the King and which are relatively independent from existing administrations.

ECRA, a spin-off of the Ministry of Electricity and Industry, has so far successfully overseen the management of IPPs and regulates prices for the power sector. At the same time, KACARE has been created specifically by King Abdullah to pursue the diversification process. The agency benefits from an independent budget of \$133 million and from a very strong mandate, including the country's representation at the IAEA (International Atomic Energy Agency). It raises the country's consciousness of the need to reform. The private sector is also engaged. It has the financial strength to launch renewable generation, and to some extent manufacturing, as well as the capacity to develop technologies.

Saudi Aramco, one of the world's most competitive multinational oil companies, managed to maintain excellence throughout the 1980s' nationalization process. The company has substantial in-house expertise and research capacities. The company declared its interest in solar power generation and launched a 10 MW project (see annex 2), working in partnership with universities such as KAUST (King Abdullah University of Science and Technology) in the western province. Saudi Aramco also has a 7% stake in SEC (Saudi Electricity Company). This ensures a minimum integration of the power and oil and gas sectors. Saudi actors also believe that Saudi Aramco will provide best practices for the development of the nuclear sector.

Furthermore, many universities and research institutes contribute to developing research: KASCT is managing nuclear research; KAUST is developing alternative energy technologies and hosts the Energy Efficiency Center; and King Fahd University of Petroleum and Minerals ranks among internationally competitive universities worldwide.

The success of the reform process will depend strongly on the ability of these agencies and actors to coordinate their strengths. Streamlining the different ministries will nevertheless be required at some point, to ensure the sustainability and speed of the process. The role of the Ministry of Water and Electricity, which ensures supplies, is not really clear. Interviews with the Ministry of Finance suggests that so far the budget for 2015 has been planned with little consideration for the impact of consumption in the power sector on oil revenues. Last but not least, policies drafted still need the approval of the government. The support of the King has also been vital, and the sustainability of the reform process therefore depends on the political context. The ability of these agencies to move from being policy

drafters to being real actors will depend on the political transition of the country.

Case Study 2 – The United Arab Emirates

The UAE is the world's seventh largest producer of oil and gas. Its proven reserves are 97.8 billion barrels for oil and 6,091 bcm of gas. These are unevenly distributed across the country. The Emirate of Abu Dhabi owns 90% of the country's gas. Gas production is declining in Dubai (113 bcm), Sharjah (303 bcm), and Ras al-Khaima (34 bcm).

Electricity consumption per capita is highest in the region, as is water consumption (550 liters/capita/day). Power capacity will have to triple to meet demand by 2030 according to ADWEC. In 2008, the country launched a diversification strategy to address the problems of gas shortage (as mentioned in the first chapter), and the subsequent use of diesel for electricity generation in the Northern Emirates.

The United Arab Emirates' power sector structure: different paths to liberalization

Oman can be attributed the title of leader for structural reform in the GCC countries. The Emirates have also been a first mover. In 1998, they introduced a law reforming the single buyer model by establishing four generation and desalination production companies, a single buyer to purchase electricity and water and to supply gas to the IWPPs, a transmission company, and an independent regulator responsible for both the economic and technical regulation of the power and water sectors. A privatization committee was established for both the power and the water sector.

So far, functional unbundling has been introduced in Abu Dhabi and separate generation, transmission and distribution companies exist. Yet the sector operates with a single buyer model, and ADWEC still owns a 60% stake in the IWPPs and the transmission and distribution sector are not privatized yet. Up to 95% of the emirates' electricity is generated by IWPPs. The power sector is now very dynamic. There are however no plans to further liberalize the power sector in the other emirates. Abu Dhabi is also willing to make ADWEA a big utility.

In principle, the seven emirates are all independent regarding power production. In reality, four main utilities supply the emirates.

Power production is usually coupled with water desalination. The steam generated by the CCGT plants is used to provide water.

In Abu Dhabi the power sector is in principle privatized through IWPPs. However ADWEA (Abu Dhabi Water and Electricity Authority) holds a 60% stake in the IWPPs. The water and electricity generated are then sold to ADWEC (Abu Dhabi Water and Electricity Company), which owns Transco (the transmission company) and also the two distribution companies of the emirate (Abu Dhabi Distribution Company and Al Ain Distribution Company). Abu Dhabi has the biggest power sector. ADWEA is the company responsible for the production of water and electricity generation. It has 10,110 MW of capacity; Dubai is second (DEWA has 6,997MW); then come SEWA 2,382 MW (including 14MW of diesel) and FEWA 1,080 MW. The economic and technical regulator for the sector is the Regulation and Supervision Bureau.

Dubai has its own utility Dubai Electricity and Water Authority (DEWA), which is still vertically integrated. So does Sharjah, with the Sharjah Electricity and Water company (SEWC) which belongs to the emirates. The four other emirates receive electricity from the Federal Electricity and Water Authority FEWA.

The transmission system is fragmented. The Emirates National Grid has integrated the power grids internally and with the GCC grid. The system will be connected to the GCC grid via Transco and the Saudi Arabian National Grid. Oman, which is already connected to Transco, will be connected to the GCC too.

Diversification is running right on time

The United Arab Emirates have started to develop an important diversification strategy for their power sector, which reflects a long term vision. In 2008, *Abu Dhabi Economic Vision 2030* recognized the need to diversify the emirates' economy and transform their natural resources into a knowledge based economy, setting the basis for Masdar City. The same year, the country issued a white paper on nuclear development. Aware of the challenge and pursuing a long term vision, the country will develop alternative power capacity on time. Nuclear power should provide 3% of the country's electricity by 2020 (1GW installed) and up to 15% by 2025 according to ADWEA. Renewables are set to supply 7% of electricity by 2020.

Building green leadership across the GCC through Masdar City

The most well known project is Masdar City. Established in 2006, Abu Dhabi Future Energy Company, also called Masdar, is a subsidiary of

Mudabala Development Company, and directly under the supervision of the Crown Prince.³² This project is therefore managed autonomously from the central government, with \$22 billion in capital. The objective with Masdar is to make the UAE a leader in green technology. The project therefore integrates research and development with investments and production. This company includes a research center and a university (Masdar Institute), a green tech cluster (Masdar City) which conducts large scale renewable demonstration projects, and three other entities: Masdar Capital, Masdar Power and Masdar Carbon, which develops CO2 reduction projects.

Wind has been tested with little success so far. Yet, several solar demonstration projects have been successful:

A 10 MW PV power station adjacent to Masdar city has been operational since 2009,

- 1MW on the roof of the Masdar Institute,
- 1MW over ten buildings in Abu Dhabi.

New solar projects have been planned. CSP (Solar Thermal Power Plants) is being developed in Masdar. The so-called Shams projects (1, 2, 3, 4, and 5) are being developed: From 2011 to 2014, one CSP plant of 100MW should enter in service every year.³³ Additionally, a 100MW PV power plant (Noor) is under preparation. Masdar is also involved in a PV roof programme with Abu Dhabi government (500MW over 10 years). Additionally hydrogen and geothermal power are being studied.

While fancy futuristic electric cars move visitors across Masdar area, the project is however still far from completed. The completion date has been extended for 9 years, pushing the deadline from 2016 to 2025. Most projects have actually been delayed: CSP Shams is one year beyond schedule; the Taweelah PV plant is supposed to produce solar PV products but will not be developed; wind projects are three years behind schedule; Noor 1 is going through a complex bidding process and the PV roof programme with Abu Dhabi government has been shelved so far.³⁴

The UAE's approach to renewables development has been project driven. Several research projects have been launched and the country is now starting large scale demonstration solar plants. There

³² The CEO of the Mudabala company is also the chairman of the executive affairs authority of Abu Dhabi serving the Abu Dhabi Executive Council, which is in turn chaired by the Crown Prince.

³³ The first contract for \$600 million was awarded to a joint venture (Masdar 60%, Total 20%, Abengoa Solar 20%) and power is planned to be sold to ADWE under a long term contract.

³⁴ With 35 companies instead of 5 to 10. Arab Energy Club, Beirut Lebanon, 28th of May 2011.

are shortcomings to such a strategy. First while the Masdar structure safeguards renewables deployment from administrative and political delaying, it is also more vulnerable to economic cycles. The project can be downsized relatively easily. Delays and difficulties to attract investments could turn the city into a sole research center; if the Masdar Institute is filled with competent researchers, offices for companies are still waiting to be built. Secondly, this strategy is not comprehensive. The development of renewable is bound to Masdar through PPAs. Little additional policy has been drafted so far and technologies developed, in particular CSP are quite expensive. Additionally, renewable electricity generation is hardly profitable, given the fact that first the UAE power mix is being gas fired, and second gas for power plants is subsidized.³⁵

The UAE's nuclear roll out

The country has the most developed nuclear plan of the GCC. The country's ambitious objectives and policy were set out in a white paper published in 2008: "Policy of the United Arab Emirates on the Evaluation and Potential Development of Peaceful Nuclear Energy". The Nuclear Energy Corporation (ENEC) was created back in 2000. A multibillion dollars deal was signed with KEPCO (Korea Power Electric) for the building of four nuclear reactors, for a total capacity of 5600MW. The first unit should provide electricity to the grid by 2017, the following three units should be completed by 2018, 2019 and 2020 and more reactors should be built after that year. The nuclear program was designed hand-in-hand with the IAEA, and the country's policy is more or less copy-pasted from IAEA guidelines.

The UAE could take advantage of a regional grid. Some of their nuclear-generated electricity could indeed be exported. Given the country's relatively small size (but high consumption), relying on a few nuclear plants with few interconnections would be unsafe. Were a regional market to develop in the medium term, the UAE could provide cheap base-load power to neighboring countries. Neighboring countries have indeed less advanced diversification plans and will in the years to come still extensively rely on more-expensive-to-operate gas and oil fired power plants. At real costs (with no fuel subsidies), nuclear electricity produced in the UAE would be cheaper to buy than electricity produced out of oil.

The development of nuclear power plants could however be problematic as regards water desalination. Water desalination is so far coupled with Combined Cycle Gas Turbines plants built along the coast.

³⁵ The pricing of oil, which contrary to Saudi Arabia reflects production costs, makes it beneficial to import LNG.

Energy efficiency in the UAE

The UAE has also considered several options for raising energy efficiency. Given its booming real estate sector, the electricity consumption of buildings is a prime target. Two building standard initiatives have been developed: the LEED initiative in Dubai and Estimada in Abu Dhabi. There has been little however implementation so far. Abu Dhabi has also launched various education and communication campaigns.

Low water and electricity prices which reduce the opportunity cost of energy efficiency and encourage wasting habits, have been already reformed in several emirates. Dubai introduced a new tariff structure or slab system in March 2008 which took effect in January 2011, and so did Abu Dhabi. Prices for commercial and industrial consumers almost doubled.³⁶ Additionally, ADWEA now sends smart bills to its consumers so as to raise their awareness. Governmental projects are also targeted. In the North of the country, around 40 social housing projects could implement environmental and consumption norms. In sum the UAE has considered a large range of options and is more advanced than neighbouring countries in terms of energy efficiency measures. The so called “smart billing” system which informs consumers of the real cost of their electricity and water consumption, as well as education and information campaigns might show some results in the longer term. But behavioral change is slow, and prices for households, the largest consumers, remain mostly unchanged for political reasons.

³⁶ DEWA increased electricity charges from 20 fils per kilowatt (KWh) to 23 fils for monthly consumption below 2,000 KWh, and from 33 fils to 38 fils per KWh for consumption of more than 6,000 KWh per month.

Case Study 3 – Kuwait's Difficult Reform Process

Kuwait has substantial oil resources, as well as some undeveloped offshore and non-associated gas resources. Its reserves per capita ratio is the highest of the Gulf countries. Kuwait ranks as the world's 9th oil producer (2.68 mb/d), with 104 billion barrels of proven reserves. Its gas resources are smaller and less developed, for technological or political reasons (it shares offshore gas fields with Iran and Saudi Arabia). In terms of renewables potential, the country is also well-endowed. It benefits from one of the highest solar radiation levels in the world, reaching 900 W/m² in coastal areas and almost 1,000 W/m² inland.

However, Kuwait's power sector development appears unsustainable. On the one hand, Kuwait's electricity consumption has been increasing rapidly in recent years, and government programs planning the development of real estate and petrochemicals suggest this trend will strengthen in the coming years. This is costly to the economy. At the same time, the power mix is still largely oil fired. Oil is therefore increasingly domestically consumed despite the fact that oil exports represent the main revenue for the country. Yet, few reforms have been pursued so far.

Kuwait's vertically integrated power sector

Kuwait's power sector is vertically integrated. The country's electricity generation, transmission and distribution is owned by the Ministry of Water and Electricity (MEW). Six fossil fuel power plants are operated by the ministry, and associated with water desalination capacity. No liberalization plans are foreseen in the near future, although there has been some progress with the tendering of IWPPs.

In 2010, the Kuwait development plan was finally passed by the parliament. A privatization law (law 39) was also passed. Now, all power plant projects above 500MW have to be IPPs.³⁷ The MEW is

³⁷ Under this new law, public shareholding companies must be established to run entities slated for privatization and at least 40 per cent of the shares must be sold to Kuwaitis in an initial public offering. A maximum of 20 per cent of the shares will be held by government institutions and 5 per cent by a company's Kuwaiti employees,

planning new power and desalination plants with IWPP contracts as part of the 2010-2014 four year development plan. In March 2011, the first tender was indeed launched to build the Al-Zour North power plant (a 1,500 MW power plant in Al-Zour estimated to cost \$2.5 billion).³⁸ Foreign bidders must apply through joint ventures with Kuwaiti nationals.

Kuwait's nascent diversification

The country is now diversifying its largely oil-fired power mix to gas. Almost all new power plants projects will be gas fired. This diversification strategy is not integrated in a comprehensive resource management plan. The country has limited non-associated gas resources, which are not yet explored as they require new technologies. The Kuwait project plans the development of domestic gas resources but the project is waiting to be implemented mostly for political reasons. The explorations of the offshore gas fields shared with Iran and Saudi Arabia are pending border agreements. Since 2009, the government has therefore been importing LNG on a seasonal basis, and since then has also increased its LNG imports. Importing LNG is quite expensive as there are no adequate infrastructures in the country. A feasibility study on the cost of a long term LNG strategy should soon be published.

Other electricity generation technologies are lagging behind. Following the Fukushima disaster nuclear projects were dropped. The country would have faced difficulties to integrate these nuclear plants into its power grid.³⁹ The Kuwaiti government had first considered the development of nuclear power and launched a feasibility study to build four nuclear plants by 2020. The size of the power plants was not determined but each would have had a capacity of around 1GW. The country also made institutional progress for the development of nuclear. Kuwait drafted a long term energy plan, an economic feasibility study and has conducted site identification based on IAEA milestones, for peaceful nuclear development. The feasibility study concluded that the Levelised Cost of Nuclear Technology would lead to significant savings. In 2009, the Kuwait Nuclear Energy Committee (KNNEC) was founded by decree. The government, like most GCC countries, had also initiated partnerships with foreign countries (South Korea, Russia and France) to import the technology through Joint Ventures. In December 2010, the Kuwait Investment Authority took a

leaving at least 35 per cent to be sold at auction to private or foreign investors. Source: <http://www.ft.com/cms/s/0/9804f9f6-7256-11df-9f82-00144feabdc0.html#axzz2297y19vX>

³⁸ Kuwaiti government figures.

³⁹ For a more detailed discussion on alternatives for Kuwait's power sector, refer to IFRI previous study, *Powering Kuwait into the 21st Century*.

stake in the French new technology company AREVA, worth €600 million.

In Kuwait, electricity generation prices are not as heavily distorted by subsidized fuels as in Saudi Arabia; nor does the country have a gas fired power fuel mix. The Ministry of Water and Electricity might therefore have an interest in developing and investing in renewables. The government has set a target of 10% of renewable energy in electricity by 2020. Kuwait is currently at the stage of developing pilot research and development projects under the impulse of the KISR (Kuwait Institute for Scientific Research) however no renewable policy or development plan has been set to match target. So far around 140 solar research projects have been completed since 1974, accounting for around US\$50 million. The Kuwait Institute for Scientific research is now testing a large variety of technologies so as to find the best applications for the country, and the country is engaging gradually in international cooperation to try to import renewable technology with a very long term approach. The Institute is studying several projects such as: 10 MW wind turbines, a combined cycle gas power plant with 220MW enhanced with solar radiation generating another 60MW. Additionally, the MEW signed an agreement in 2008 with Toyota T Suchu Corporation (a Japanese company) to provide assistance for projects carried on by the government; including in particular building a 1,250MW solar PV plant in the east.

Kuwait's energy efficiency measures

The price of electricity in Kuwait is the lowest across the GCC, and this hampers efficient demand-side measures to reduce electricity consumption. In this context, investment in building retrofit and optimization capacity is unattractive. Several appropriate measures were already proposed by the government, such as the introduction of price according to consumption brackets, which would be made in favor of lower incomes, but they were rejected by the Parliament.

Kuwait's institutional setting

Very few actors have been empowered by the government to pursue reforms so far. The Ministry of Electricity and Water is responsible for the operation and the development of the sector, but it has access to very cheap fuel supplied by KPC (Kuwait Petroleum Corporation). So far the Ministry has therefore been mainly concerned with the quality of fuels for its power plants. It for instance opposed the use of heavy fuels, as it reduces their efficiency and requires higher levels of maintenance. At present Kuwait power system is quite easy to operate and the Ministry as long as it operates independently from other actors and benefit from subsidized fuels, the MEW will probably

show little interest for complex technologies and grid management systems. The Kuwait Institute for Scientific Research is Kuwait's voice for the promotion of renewables.

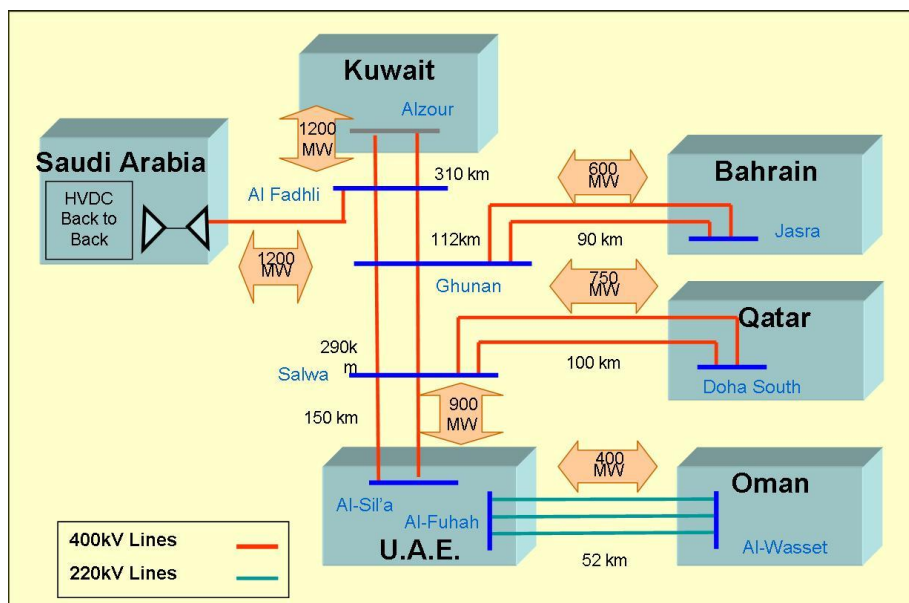
Up until now, the country is suffering from the lack of an integrated vision, with each actor of the power chain having its own views as regards the use of fuels. The country's political configuration – with the parliament having to approve budget lines – has resulted in delays for project implementation as factions in the institution distrust the government's management. The country has therefore less flexibility to create agencies to pursue reforms. The private sector is also (consequently) less active than in other countries in developing alternative technologies, and there are fewer big companies able to develop technologies.

Regional Integration as a Driver of Reform

Plans to interconnect the national grids of the GCC countries date back to 1982. Studies proved the technical and economic feasibility of such plan and in 2001 the idea was finally revived with the creation of the GCC interconnection authority by a joint Royal decree. In 2004, the GCC ministries of energy agreed to finance the grid for a total amount of \$3 billion.

Phase 1, called the GCC North Grid, interconnects Kuwait, Saudi Arabia, Bahrain and Qatar. Phase 2 connects the UAE's independent system with Oman, and Phase 3 connects the south and the north grid.

Map 1: GCC Interconnection Scheme



Source: Arab Fund for Economic and Social Development

Initially the regional grid was framed as an emergency mechanism, but its aims have evolved. The grid now purposes to reduce investments in power capacity in the long term, by sharing power generation reserves and investments in power generation infrastructure. Sharing reserves would avoid building loads of peak power plants which run only a few hours per year, and therefore reduce the cost of the electricity production system.

The grid can also be a source of diversification, with countries exporting their nuclear electricity for instance. Nuclear power plants can be built in smaller countries.⁴⁰

A regional electricity market would also favor the running of the cheapest power plants. If prices were set regionally, electricity markets liberalized and the grid integrated, then the cheapest power plants (at equal fuel costs) would be used first, displacing the old, inefficient power plants. This would in turn contribute to enhancing the energy efficiency of the power sectors across the GCC countries. An integrated regional power grid finally offers trading opportunities and gives more freedom for the strategic localization of power plants, in particular renewable.

The interconnection typology is a hybrid system between the neighbor-to-neighbor principle (tying one system to another) and a common link typology, whereby each system is tied to a backbone, providing direct access to any other interconnected system. The system now provides direct access to all countries which require the use of the UAE system, except Oman. Phase II of the Grid is now operational.⁴¹

The GCCIA goal is to link-up the GCC countries' electricity markets. It therefore advocates liberalization of national markets, the move from a single buyer model to a wholesale market, through the unbundling of the power sectors.⁴² However the different electricity price structures, including direct and indirect subsidies, jeopardize the efficiency of the system. If the interconnection allows the trading of electricity, Saudi Arabia SEC will be advantaged. The subsidy of oil prices for its power plants would give the company a significant advantage over other regional utilities. Saudi citizens would on the other hand subsidize low electricity prices in other countries.

The upgrading of prices is therefore a pre-condition to the operation of the market. Moreover the interconnection capacities are limited. To establish electricity trading, the interconnection capacity must at least cover the share margin (i.e. around 10%). The capacity should be even larger as the GCC countries have large peak load demand and the peak is simultaneous in neighboring countries. As a result, after ten years, the interconnection grid can hardly be used as an emergency mechanism.⁴³

Finally, there are geopolitical and national economic considerations behind the GCC ideal. Countries developing nuclear power have voiced their interest for a regional grid. The share of SEC

⁴⁰ Nuclear power plants are usually more risky for small countries, as nuclear energy makes the electricity generation reliant on fewer power plants.

⁴¹ The GCC power grid: transforming the GCC power sector into a major energy trading market.

⁴² <http://www.gccia.com.sa/articles/Paper-Cigre.pdf>

⁴³ For more details on the GCC interconnection grid, refer to the previous IFRI publication *Powering Kuwait into the 21st Century*.

into the GCCIA (31.6%) shows companies' interest in becoming a large utility company. Saudi Arabia is also looking for the integration of the GCC from a political perspective.

The nascent GCC electricity market should avoid making similar mistakes to the EU. For a long time, the creation of an integrated electricity market in Europe was thought of as a means to decrease production costs. It is now driven by concerns of the circulation of renewable energy sources, long term adequacy, and power intermittency back-up supplies to provide sufficient generation capacity. Capacity mechanisms are being designed to balance production and consumption and they are costly. In the GCC, the stated objective is to have an integrated market. Yet the reality reveals that there is no real power market, that there are already distortions due to different price structures, and that the power mix will likely remain in the hands of states. GCC countries should thus be aware that the un-coordinated development of renewables could also jeopardize the market integration objective.

The Implications of the Global Financial Crisis and the Arab Springs on the Reform Processes

In recent years, high oil prices have boosted GCC states' revenues. Most of them have used these surpluses to finance major projects, and to fund the creation of institutions. This reform process has given birth to a new generation of young technocrats, in turn drafting new regulations. The Gulf countries are now embarked in particular on electricity sector reforms at varying speeds. The ongoing reforms are necessary to ensure the sustainability of the Gulf economies and stable revenues for state budgets. But will the current climate, the euro area crisis, the Arab revolutions, and rising tensions with Iran hold back the ongoing reform process?

The tense regional political context has revived internal community tensions, as in Bahrain, and political tensions, particularly in Kuwait. The Arab revolutions have indeed reinforced opposition calls for a full parliamentary democracy in Kuwait, in which government would be chosen by elected majority blocks.⁴⁴ Political turmoil is not new in Kuwait. Kuwait was actually buffeted by regular demonstrations in 2011. In six years, four parliaments were elected. The Emir once again dissolved the Assembly in 2011. The former prime minister, a nephew of the Emir was finally removed in 2011, after a series of corruption scandals. The Islamist opposition, which acceded to Parliament in 2006, made gains in the February 2012 elections as it campaigned against corruption. The Emir nevertheless refused to give this opposition force the nine cabinet posts it was asking for. Since then, it has questioned cabinet ministers and forced the resignation of two ministers, including the finance minister. This in

⁴⁴ Kuwait has one of the most democratic systems in a Gulf region ruled by autocrats. However political parties are banned so politicians tend to form blocs based on religious and tribal ties. This complicates policy making. The Emir chooses the prime minister, who in turn forms his cabinet. The cabinet has to deal with Kuwait national assembly, Majlis Al Umma (House of the Nation), composed of lawmakers. The Emir, Sheikh Sabah Al-Ahmad Al-Jaber Al-Sabah, has the power to dissolve the Assembly. He decided to do so as the February 2012 elected parliament was not favorable to the government policies. Repeated fights between the parliament and the government hamper the country to pursue the necessary economic reforms. Source: <http://news.kuwaittimes.net/2012/06/26/kuwait-faces-long-run-instability/>

turn has revived communitarian tensions, and is blocking the \$107 billion Kuwait Development Plan (which includes power sector projects).

The context also sends a blurred message on oil prices. On the one hand, the Arab revolutions and tensions over the Iranian nuclear programme have pushed oil prices up. This has benefited the Gulf exporting countries which saw their revenues increase substantially. Higher than expected oil prices have led to impressive budget surpluses. For the first eight months of 2011-2012, accounting revenues from oil in Kuwait reached KD17.8 billion (\$64.8 billion), already exceeding planned revenues by KD5.4 billion. In the short run, the impact of Arab revolutions on the GCC economies has been positive. On the other hand, the euro area crisis has exercised downward pressure on oil prices.⁴⁵ The GCC countries are not extensively exposed to European debt, but the crisis could lead to the decrease in Foreign Direct Investments and losses for banks having massive shares into European Banks.⁴⁶ This in turn would impact negatively power sector projects.

In the long term, the impact of the current regional political turmoil would be negative. Most GCC countries considered the Arab revolutions as a threat to their stability, even more so as riots exploded in Bahrain. They responded by increasing substantially social packages. Domestic spending pledges in the GCC for 2011 amounted to \$150 billion (12.8% of total GCC GDP) according to the Carnegie Center for International Peace, and they keep increasing. In Saudi Arabia in particular, wage bills are rising impressively. In February 2011, King Abdullah announced the spending of \$37billion; in March 2011 another \$97 billion to be spent during three years were announced; up to 60,000 public sector jobs will be created inside the Interior Ministry; 50,000 social houses will be built; the public sector minimum wage has been increased to a level three times higher than the private sector wage.

This will have negative long term consequences. Experience reveals that increases in public sector spending are very hard to reform; in particular public jobs will be hard to cut in the future. Very low energy and electricity prices will probably further encourage the misuse of resources. Large wages bills would increase inflationary pressure by inducing high rates which could impact negatively on bank loans, and in turn IPP projects while distorting the economy. Bidding frameworks for IWPPs like in Ras Al Khair have been extended, and some projects are already being delayed. The feeling of impunity and wealth driven by large oil and gas export revenues which leads to increasing wage bills is dangerous. If reforms of the

⁴⁵ Saudi Arabia recently decided to decrease its exports and switched them towards Asia, as oil prices are decreasing.

⁴⁶ Ibrahim Saif, Rand Fakhoury , Lessons from the Gulf's Twin Shocks, Carnegie Endowment for International Peace, 16th February 2012

electricity sector, including price reforms, are slowed down, revenues will decrease in the longer term. There were already protests in Saudi Arabia in 2008 following power cuts in summers, when temperatures reach 40 to 50 degrees.

The need to sustain economies and social contracts could lead producing countries in the long term to start opening investments in exploration and production. The IAE estimates that the region needs \$100 billion investment per year. This would help to increase oil and gas production and give more time to these countries to reform their domestic consumption. This prospect is however dubious for the GCC states although some tenders have been opened in the gas sector. Were the Arab revolutions and internal politics turn into nationalist backlashes, the reverse could occur with very negative consequences for these regimes' stability.

Conclusion

All GCC countries are facing the same challenges, but they are not reforming their power sectors with the same intensity. All countries are developing a single buyer approach, but they are targeting different levels of privatization and market creation. Having chosen a gas fired power mix, the UAE has faced the issue of gas shortages earlier. Like Oman, which has fewer natural resources, the UAE has been pioneer in reforming its power sector structure and diversifying its power mix. Abu Dhabi is clearly a leader, while other emirates are lagging behind in terms of reforms. Saudi Arabia also needs to respond faster to this challenge, due to its high birth rate. The country has now launched very ambitious structural and diversification processes; although the later still need the approval of the government. In both countries reforms have been supported by quasi-governmental agencies and a dynamic private sector.

Saudi Arabia is integrating diversification in research and development with the underlying objective of diversifying its economy. It is taking advantage of a developed university base. For this purpose, Abu Dhabi has created Masdar, but the project is dependent upon the business cycle. Private sector development would actually require more strict regulations to take advantage of electricity generation from renewables. Renewable need to be part of overall planning strategies, which would help to internalize costs and allow further market liberalization. Saudi Arabia is the sole country with a proposed policy framework for renewables development and market integration so far; other GCC countries have a Private Purchase Agreement approach. Kuwait has a smaller population, but more oil in its power mix. The country is lagging behind both in terms of structural reforms and in terms of renewables development. Lastly, the safe development of nuclear power will require independent technocratic management and needs to be integrated into long term visions.

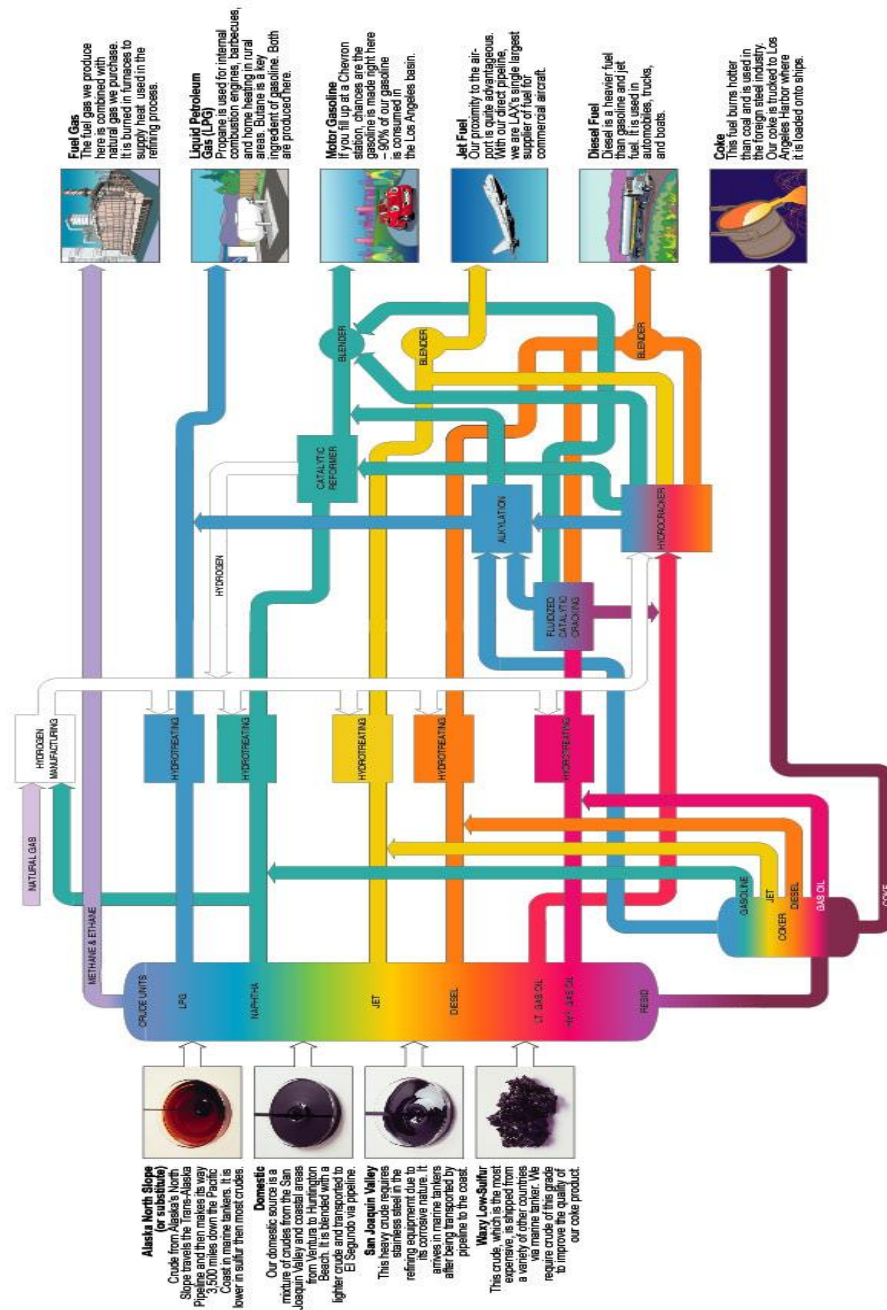
Another solution would be simply to “go on a diet”. Energy efficiency is in waiting to be pursued, and results across the GCC countries have so far been limited. The reforms of prices are important for diversification, energy efficiency and renewables development, but it proves politically difficult. Energy efficiency should be urgently enforced, as buildings consume the largest share of electricity. This represents a good opportunity to develop green markets and diversify economies. Yet, as electricity prices do not reflect costs, they hamper the liberalization of electricity markets and

the development of alternative technologies, such as demand side measures in particular, as well as the deployment of renewables in Saudi Arabia or Kuwait. Adjusting the price to the long term marginal cost of electricity is an obvious solution. So far, low prices are sending the wrong signals to populations unaware of the challenges facing their power sectors.

Calculating the cost of subsidizing fuels for power plants and electricity for consumers would be a good first step to raise public awareness. Oil may be manna from heaven which benefits GCC nationals, yet subsidizing energy and electricity prices appears to be the worst way realizing such benefits. This political choice does not make economic sense. Actors interviewed across the region all acknowledged this specific problem and more generally challenges facing the power sector; the issues are political and cultural, and change will require political courage. The present context does not help to sustain reforms. On the contrary, the GCC countries are facing increasing difficulties in finding investors and seem to be less willing to reform prices.

The lack of integrated vision and coordination of actors in the power sector chain is also responsible for this situation. Almost all actors are conscious of the needs of reform. Yet, in Kuwait it failed to result in an integrated vision; in Saudi Arabia, the impetus still relies on a limited number of actors and in the UAE the difficulties faced by the Masdar projects could delay planning. Electricity is considered to be the oil and gas sector's poor relative, in particular by oil and gas actors, and insufficient attention is paid to it. Unless reform measures are pursued nationally, the integration into a national grid will not lead to the desired benefits.

Annex 1: Refinery Products



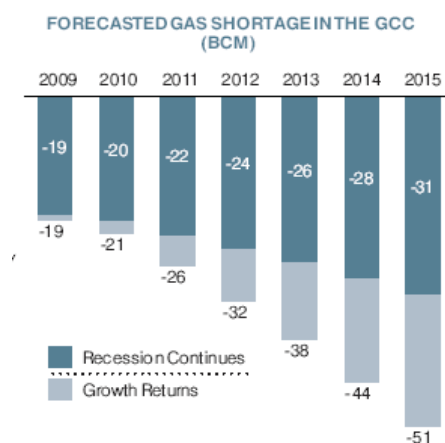
Source: Independent Refining

Annex 2: RES Projects in the Gulf Countries

Country	Projects	Advancement
Saudi Arabia	Solar Thermal Plan (2-4MW)	Planned
	Solar Facility on parking lot (10 MW)	Planned
	Solar power desalination plant	Under construction
	KAUST solar rooftop PV Panels (2MW)	Completed
	Solar Field	Under Construction
	Solar Park (3.5MW)	Under Construction
UAE	Dubai Solar Park (10 MW in 2013)	
	2 wind energy plant (each 30 MW)	Planned
	Solar Power Plant (40MW)	Planned
	Noor 1 Solar PV Plant (100MW)	Planned
	Shams 1 CSP Plant (100-125 MW)	Under Construction
	2 solar power plants	Under construction
	Floating solar island project (1MW)	Completed
	Masdar Institute Roof (1MW)	Completed
	Solar PV Park (10 MW)	Completed
Kuwait	Solar Power Plant (1250MW)	Planned
	Solar component in combined cycle gas power plant (60MW)	Planned
	Wind Turbine (10MW)	Under Construction

Qatar	Solar Power Plant (100MW)	Planned
	Biomass Plant (40MW)	Completed
Oman	CSP power project (50-200MW)	Planned
	Solar Thermal Powered oil recovery plant (600l/hour)	Planned
	Biofuels date palm factory (900,000 l/day)	Planned
	PV Demonstrator (12 MW)	Completed

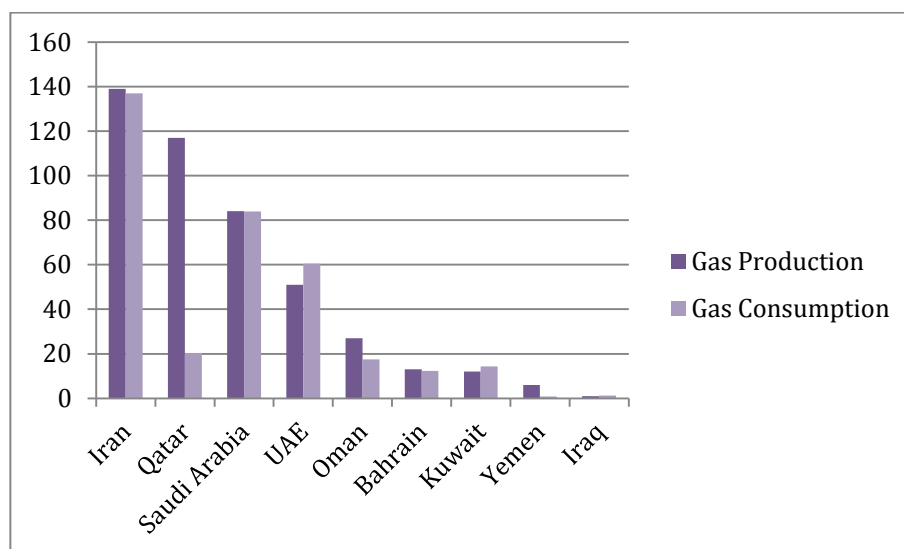
Annex 3: Gas Shortage in the GCC



Source: Energy Information Administration (EIA); International Energy Agency, "World Energy Outlook 2005"; OPEC, "World Oil Outlook 2009"; "BP Statistical Review of World Energy, June 2009"; Booz & Company analysis

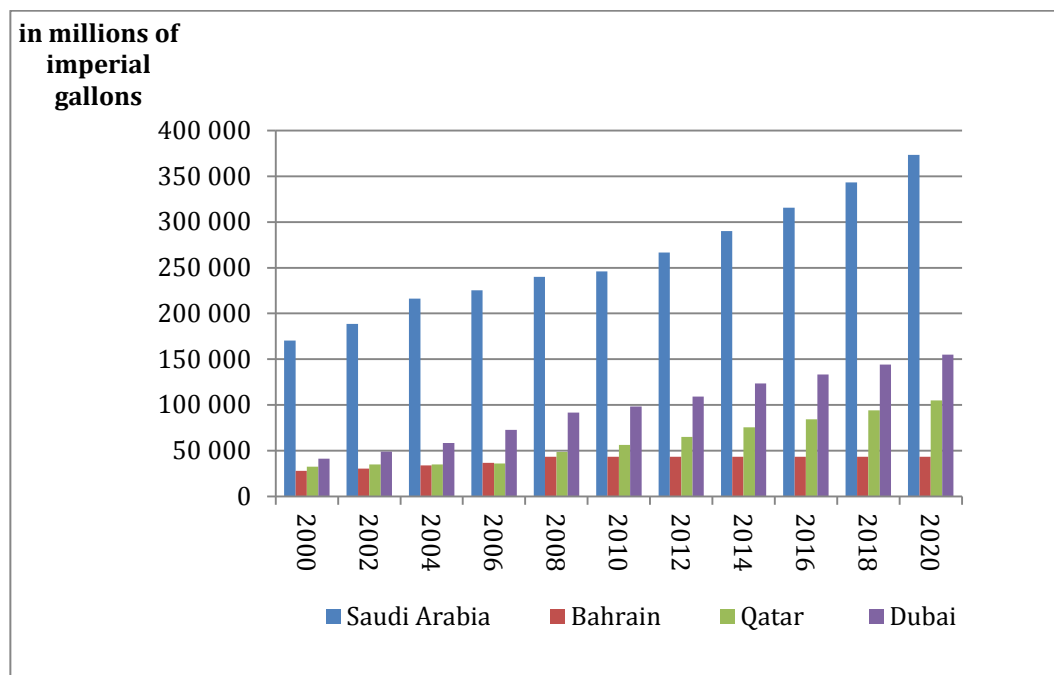
Source: Rabia Ferroukhi, IRENA, 2012 Presentation at Qatar University

Consumption versus Production of Gas in the Gulf Countries in 2010



Source: BP Statistical Review 2011, EIA 2011

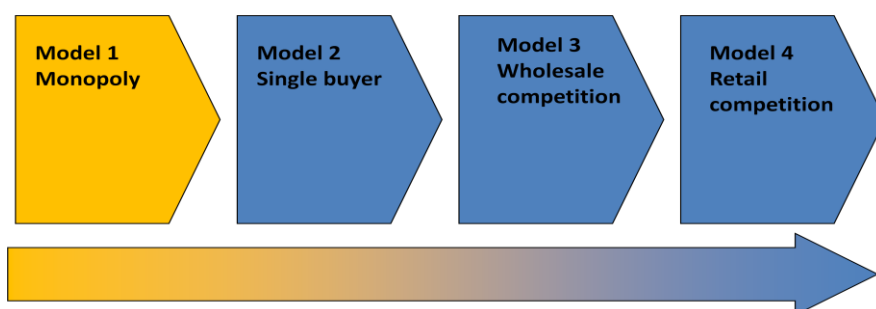
Annex 4: Water Demand Projection in Selected GCC Countries



Source: Economist Intelligence Unit Limited, 2010 quoted by Dr. Rabia Ferroukhi (IRENA)

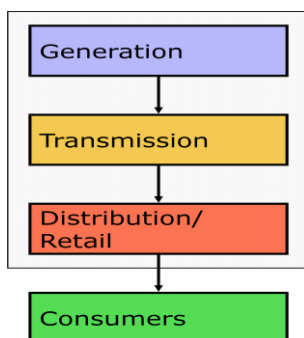
Annex 5: Electricity Market Liberalization Steps

Internationally, models for electricity sectors differ largely. The most well-known models are: (1) the monopoly model, (2) single buyer model, (3) wholesale competition model, and finally (4) the retail competition model. The order of these models corresponds to the degrees of liberalization within the electricity market. Applied to a given country, a model might have specific characteristics that are not described here.



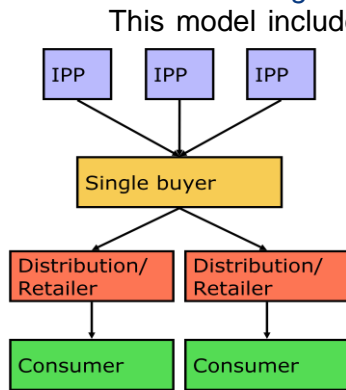
Model 1: Monopoly at all levels

The first model presents a full, vertically integrated model, with a monopoly in generation, transmission and distribution of electricity. All the power plants are then normally remunerated on a “cost-of-service” basis: a fixed tariff is given to the utility for the service provided on expected costs. This model is comfortable for utilities since there is a high certainty of income. There are however very limited incentives for cost reductions and innovation in this system.



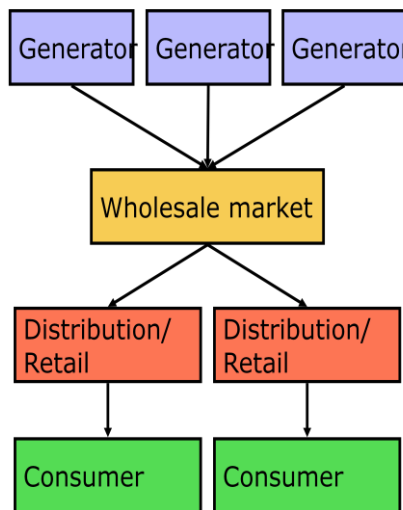
Also, due to the dependency of society on the electricity produced by the monopoly, mistakes in investment, demand forecasting, and technological obsolescence are directly passed on to consumers. This could eventually lead to abuse of the monopolistic situation whereby the utility becomes a tax collector or subsidy distributor.

Model 2: Single buyer



This model includes some decentralized actors in generation and distribution, by the use of PPA contracts. This situation might lower capital costs in comparison to the Model 1 situation, because of the higher level of competition. However, besides this, the model is very similar to Model 1. The IPP's or IWPP's (Independent Power and Water Producers: i.e. private generators or water producers), are also remunerated here on a cost-of-service basis, given a regulated tariff. Because of this, the risks of IPPs are passed on to consumers. There is some competition on the generation side, while the purchasing agency retains strategic centralized control. The single buyer needs to be finely controlled in order to ensure there is no corruption with PPA contracts, and independence needs to be ensured if electricity generated is to be dispatched efficiently.

Model 3: wholesale competition



In this model there is no single buyer, but a whole sale market where there are free transactions between distributors and generators directly, and by those sharing risks. Distributors (now multiple purchasing agencies) retain a monopoly over final consumers. Tariffs are regulated for distribution. Social policy obligations must be met via regulated tariffs. There is no central planning of generation but free entry into the market. The problem that might arise is the difficulty of covering potential

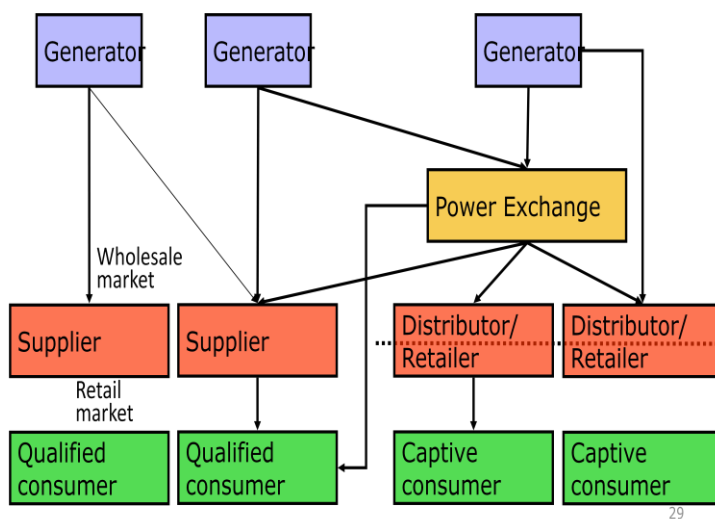
required generation but which is not operating for much of the time in the market (stranded cost problem). This long term guarantee of supply is in principle left to the market, which sometimes raises problems.

In this system, new actors are involved: a system operator and market operator in order to support market transactions and manage the transmission capacity technically (system operator). The benefit of this system is to provide a strong incentive for efficiency in generation. IPPs may choose between contracts and the spot market. For the network, there are regulated network access charges. There might be pressure coming from consumers to implement retail competition, whereby they are able to decide from which utility they buy electricity in certain times. This is shown in next model.

Model 4: wholesale and retail competition

In this model, all customers have access to competing generators either directly or through their choice of retailer. Fixed regulated tariffs are only used as a back-up option if selected generation fails. In this model there is a complete separation of generation and retailing from the networks (transmission & distribution), in order to prevent monopolistic behavior. The spot market is also essential. Furthermore, here long term guarantees of supply are left to the market in principle, which might raise problems. Controlling market power remains an important issue. New problems appear which were previously internally managed by the monopolies: the management of CO₂ emissions and network congestions (externality management).

(Source: shuttleworth, 1996)



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