

## Kuwait Utilities Sector

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### Summary

Kuwait has one of the highest per capita energy consumption in the world. According to Global Footprint Network, an average Kuwaiti uses 22 times more resources than the country provides per person. Apart from extreme weather conditions, there are several other reasons for the high energy consumption in Kuwait; one of the primary reasons being the heavily subsidized cost of electricity. Electricity in Kuwait is charged at two fils per kWh, which is a fraction of the 38 fils it costs to produce. This comes as prices have remained the same since 1966 when it was slashed from 27 fils per kWh. The country's budget for the fiscal year 2012/2013 lists the total government subsidy for consumer services at KWD 6.3 billion. Out of this, KWD 3.1 billion goes towards electricity.

Moreover, electricity consumption in the overall gulf region is relatively higher because of the energy-intensive water desalination plants, which filter salt water into fresh water. The increasing population in Kuwait and the scarce water resources puts excessive pressure on both electric as well as water utilities to increase their output with higher investments in new plants.

The Ministry of Electricity and Water (MEW) is the sole supplier of electricity and water resources in Kuwait. It is also the central regulatory body that manages the supply/demand situation of these two scarce resources in the country. According to the statistics from the MEW, the rate of energy production almost doubled over the past decade in order to cater to the increasing consumption that is fuelled by the rapid growth of Kuwait's private and public sectors over the years.

With record high energy consumption at the onset of summer 2013, it is absolutely crucial that the country prepares itself to overcome any kind of electricity shortage. On the other hand, the water utility section has to prepare for future growth in water consumption, with the help of new water treatment facilities and water desalination plants. A diverse, long-term water treatment and management plan is the only way to guard against dwindling supplies.

As an effort to improve the ties between the GCC countries as well as to better manage excess/shortage of electricity, the six countries in the GCC formed the GCC Interconnection Authority (GCCIA) with a primary objective to increase cross-border electricity supply. The electricity network has helped share electricity reserves and act as a catalyst to exchange energy whenever required during emergencies.

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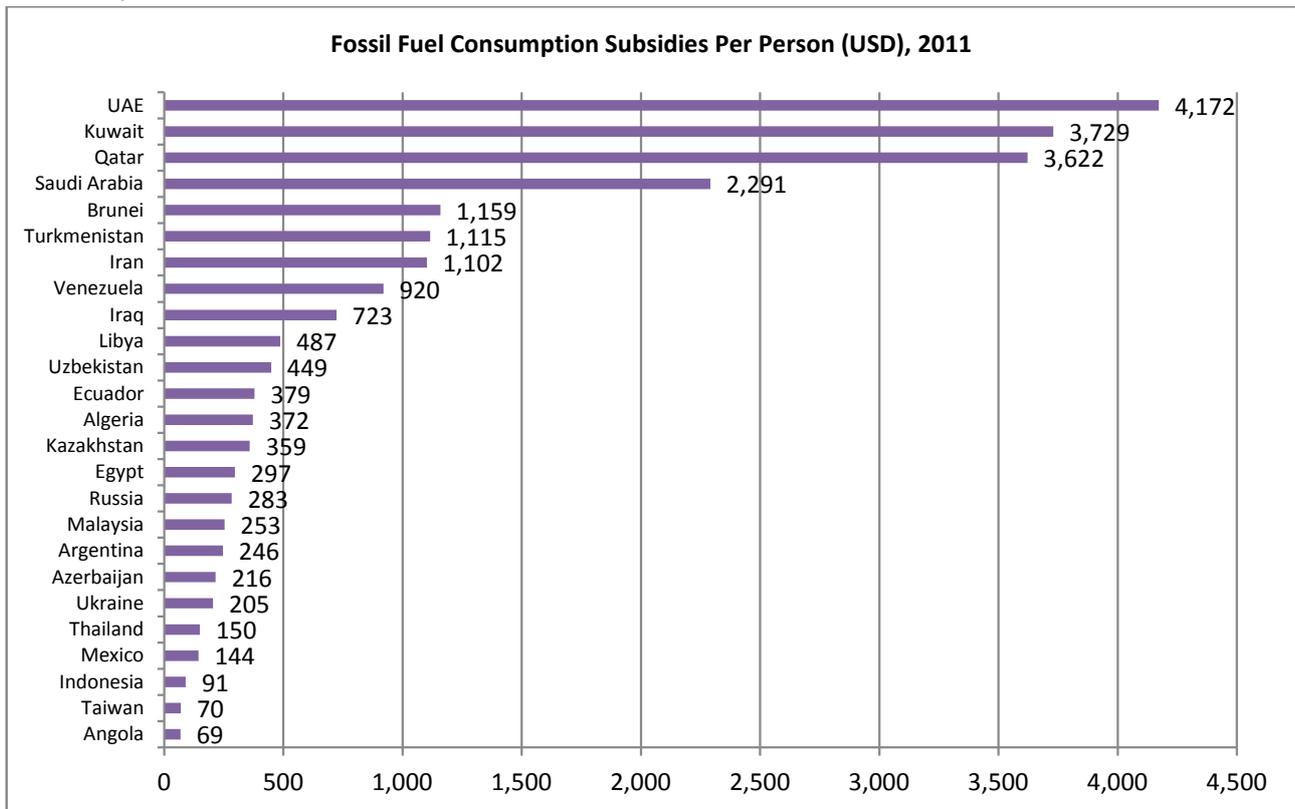
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**GCC Utilities Sector**

The GCC region accounts for one of the highest consumption of power and water resources as compared to other regions of the world. Demand for electricity has been growing at more than 8 per cent per annum for the past several years for most of the GCC member countries. However, despite the high consumption, the region has never faced acute extended shortages of these resources due to several factors that include long term planning at the initial stages, timely implementation of expansion plans as well as abundant resources at the disposal of the government. The financially strong governments with years of budget surpluses also enable them to heavily subsidize these resources. The amount of subsidies spent by different countries are shown in the below exhibit, with four out of the 6 GCC member countries making it to the top five spenders.

**Exhibit 1: Top 25 countries in terms of fossil fuel subsidies**



Source : World Bank

The members of the GCC are in the process of reforming the power and water sector. Each country is at a different stage of these reforms, with the main objective of improving future supplies, private sector participation that will lead to reduction in costs as well as for sharing the financial burden and better regulations to avoid exploitation of consumers. Moreover, as the countries strive towards diversification of the economy towards the non-oil sector, there is an implied pressure to maintain sufficient resources to cover future requirements. Some countries have also committed billions in the development of clean and sustainable energy.

The region is now home to a number of conferences, especially to discuss and pool in expertise from participating international power companies to develop the energy sector. The 11th Power-Gen Middle East conference in Doha, Qatar, projected that the GCC countries are expected to infuse more than \$63 billion into electricity projects over the next five years and installed capacity is likely to reach 170,000 Mega Watts (MW) by 2019. According to a recent study by Apicorp, the GCC is projected to record the highest power demand growth of around 8.5 percent in the region in

the medium term in order to meet the massive requirements for water desalination and air conditioning. Moreover, nearly 200 power projects are on the agenda to be implemented over near future.

On the other hand, despite being one of the hottest regions in the world, with scarce water resources, the GCC region accounts for one of the highest water consumption levels as low costs lead to wastage and extensive usage. In addition, there are very few water bodies in the region and the primary source of potable water are the fossil ground water resources and the desalination plants. As it becomes difficult to extract ground water, the authorities are now focusing on establishing increasing number of water desalination plants. Moreover, since a majority of the available water resource (almost 80%) is utilized for agriculture, private cultivators are now purchasing huge plots of arable land in other countries with adequate supply of water to cultivate crops. This, along with ensuring food security, also helps to conserve the precious water resources. Ethiopia, Mozambique and Ghana are some of the most favored destinations for buying farm lands.

As mentioned earlier, the process of seawater desalination is one of the most energy intensive processes and increasing the number of desalination plants will in turn lead to higher requirement of electricity. According to Masdar, a renewable energy company in Abu Dhabi, seawater desalination requires about 10 times more energy than surface fresh water production, and its costs are projected to increase by 300 per cent in the future. In order to deal with this issue, companies are testing the feasibility of installing desalination plants powered by renewable technologies. Masdar is initiating three pilot projects with the aim of developing a commercially viable seawater desalination technology by 2020.

There are a couple of key themes and characteristics that differentiate the GCC Utilities sector from the rest of the world. Some of these characteristics are mentioned below:

**Low cost of production:** Being some of the biggest oil producing nations, the GCC countries have significantly low cost of producing oil. These countries always had the embedded advantage of cheap and abundant oil supplies for producing electricity in traditional plants. This saves on time as well as the cost of setting an infrastructure for other feedstock that can be used for generation. That said, with the rise in oil prices, it makes economic sense for the GCC to save on self consumption and sell the oil in the international market at a much higher price by substitute oil with other feedstock or other ways of generating electricity.

**Delayed spending:** GCC countries are not been forthcoming for making energy investments. The fact that there is no nuclear power plant in the region justifies this point. It is only recently that the countries have formalized the process of setting authorities and framework for power sector investments.

**Cash rich countries:** Making investments in the power sector has never been a financial constraint for the six countries. At the right time and with the right stimulus, the countries have started investing in diversifying the source of electricity in the region. They are even cooperating with in the form of a national grid to support at times of scarcity and shortage.

**Political overhang:** Delayed regulations and reforms is one of the key impediments in this region. For instance, in Kuwait, the various infrastructure projects are already planned, however, regulatory hurdles and the political climate in the countries leads to delays in the implementation of key infrastructure projects. Cumbersome bureaucracy, while improving, continues to hamper approvals and other administrative procedures.

**Heavy subsidies:** Cost of electricity and water are heavily subsidized by a majority of the GCC member countries. With prices set so artificially low, consumption has grown by leaps and bounds. The GCC countries are some of the highest consumers of water and electricity in the world with lack of social awareness towards conserving these critical resources. However, this approach is changing as countries get ready to face higher demand in the near term.

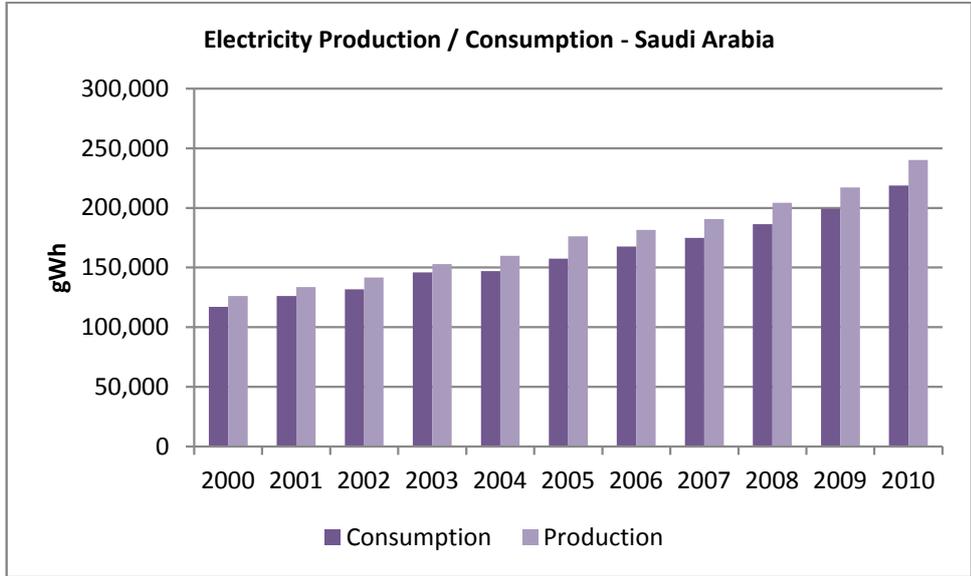
**Rising Population:** According to an EIU report, total population of the Arab Gulf states, including Yemen, is forecast to increase by a third, to 53 million people by 2020, with a majority of them less than 25 years of age. In order to meet this domestic demand, GCC countries will have to cut back on hydrocarbon exports sold on the global market and use it for self consumption.

In order to deal with some of the challenges mentioned above, GCC member countries are implementing a number of projects over the coming years. Mentioned below are key developmental projects in the power and water utilities sector of individual GCC member countries:

*Saudi Arabia*

The country is home to one of the biggest power and water sector boom in terms of both capacity expansion as well as state-of-the art projects. According to initial estimates, an investment of \$133 billion (SR 502.5 billion) is expected to be spent for various power generation and water projects in the next decade. Out of this, energy projects are expected to cost \$79.9 billion (SR300 billion) and \$53 billion (SR202.5 billion) would be spent on various water projects to be completed by 2022. The Saudi Arabia government initiated the consolidation of the electric utility sector in 2000 when it merged 10 local electricity firms to form Saudi Electric Company (SECO). The company engages in the generation, transmission, and distribution of electricity in the country and generates electricity through diesel, combined cycle, gas, and steam facilities. According to BusinessWeek, SECO owns and operates power generation capacity of approximately 51,148 MW; power transmission networks, including 642 transmission substations with 1,875 transformers with a total capacity of 15,036 MVA and network length of 49,675 ckm; and power distribution networks comprising 344,292 transformers with a total capacity of 160,277 MVA and network length of 409,289 ckm. According to recent developments, SECO’s board approved splitting the company into six smaller companies; four will operate in power generation, one in power transmission and one in power distribution.

**Exhibit 2: Production and consumption of electricity in Saudi Arabia**



Source : World Bank

According to MEED, the number of power contracts awarded slowed down in 2012, however the SECO has a number of contracts in the pipeline. SECO had 50.9GW of power generating capacity as of 2012, with almost 8.9GW capacity with non-SEC companies. SECO has plans to expand its total capacity to 131.6GW by 2021 to support the higher demand from the rapidly growing population.

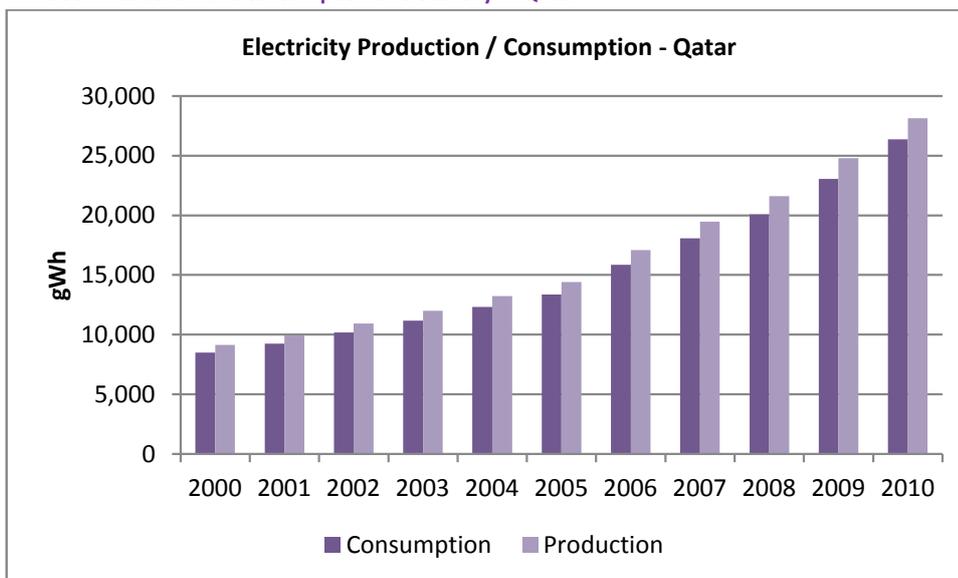
For ample water supply, the Saline Water Conversion Corporation, an entity under the Ministry of Water and Electricity, recently announced that the world's largest desalination project in Ras Al-Khair is 75% complete and will start producing electricity by the third quarter and water by year end 2013. The capacity of the plant is over one million cubic meters of desalinated water and 2,400MW of electricity. The total investment in the project is SR 23 billion (\$6.1 billion).

The country also has ambitious plans to build nuclear plants to generate power. According to the World Nuclear Association, Saudi Arabia plans to construct 16 nuclear power reactors over the next 20 years at a cost of more than \$80 billion to generate 17GW of electricity. The country's first nuclear plant is expected to be operational by 2020. On solar front, the country has already started implementing a number of solar power initiatives, with plans to invest \$109 billion in solar projects and generate a third of the nation's electricity (41,000 MW of solar capacity) by 2032. The first solar-power facility is expected to be operational by 2015. One of the unique solar projects it awarded recently includes a trial project for solar powered street lights. When the first stage is successfully completed, 150,000 solar-powered light poles will be put up on the streets of Makkah, covering a 180-million square meter area. There is also a potential to export solar electricity to Europe in winter, when cooler temperatures reduce the need for air conditioning in the kingdom.

**Qatar**

In line with other GCC countries, Qatar also has one of the highest per capita consumption of electricity and water largely due to heavy subsidies from the government. According to the World Bank, on an average, Qatari-and UAE-residents consume about 11,000 kWh of electricity per year, while UK residents consume 5,730 kWh and Indians 550kWh. The country's electricity requirement is rising at the rate of about 7% a year. Qatar Electricity & Water Corporation or Kahramaa is the authority responsible for supplying water and electricity in Qatar. The authority has been actively taking initiative to invest in projects and ensure continued supply of these two vital resources in the future. According to an earlier forecast, Qatar required an additional 2,000 MW of electricity capacity and 70 MIGD of water, in addition to 40 MIGD of water from the RO plant, for the 2012-2017 forecast period, reaching 442.8 MIGD by 2017.

**Exhibit 3: Production and consumption of electricity in Qatar**



Source : World Bank

In terms of water supply, Qatar produces about 332.8 million imperial gallons per day (MIGD) of desalinated water using combined cycle power and desalination plants that generates electricity and simultaneously desalinate water. The country is in the process of using a more efficient desalination technology called Reverse Osmoses (RO), which consumes less energy and can be constructed as a stand-alone plant without being combined with power generation plants.

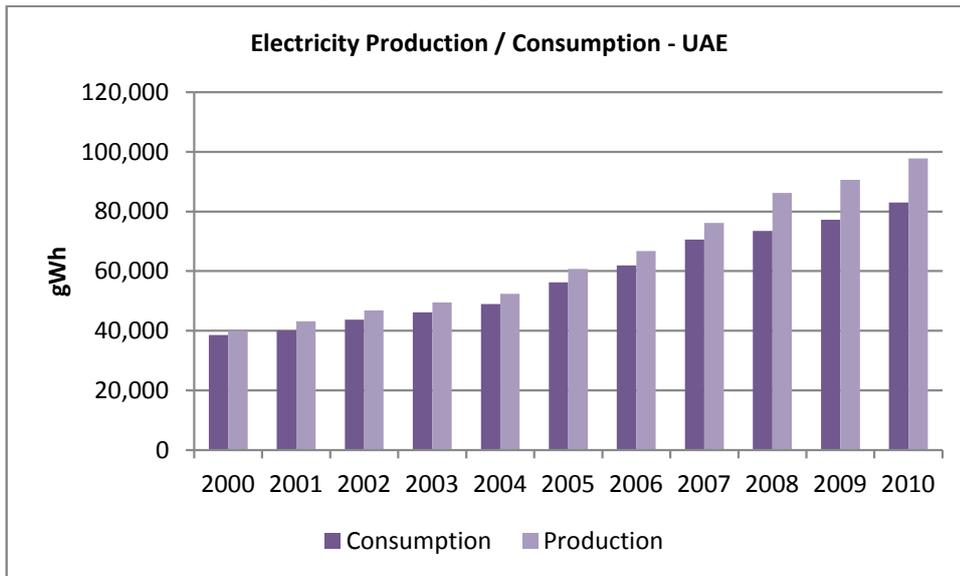
In order to conserve electricity and water and to inculcate the habit of responsible consumption, the country has introduced “Tarsheed”, a national campaign for the conservation and efficient use of water and electricity, which targets to reduce the average per capita water consumption (measured in cubic metre per person per year) by 35% in five years and decrease the average per capita electricity consumption (in kWh per person per year) by 20% in five years.

Qatar is also in the process implementing its solar strategy on a piecemeal basis by splitting the targeted 200MW of solar power (equivalent to 2% of Qatar’s installed capacity) into smaller projects. Qatar Foundation has developed the country’s first polysilicon plant for the production of photovoltaic cells to harness solar energy. The first pilot project to supply 10MW of electricity is being tendered. After the successful implementation of the pilot project, Qatar aims to generate the targeted 200MW electricity by 2020. Qatar is also encouraging the private sector to install their solar panels and produce electricity, which will be ultimately connected to the master Kahramaa grid. In order to accelerate investment in renewable energy technologies by private sector entities, Qatar is also mulling a feed-in tariff mechanism to provide acceptable returns to the investors.

**UAE**

The pace of growth UAE’s economy and the huge infrastructure development necessitates the provision of continuous supply of water and electric resources. Energy demand in the UAE is growing at an annual rate of about 9 per cent – three times the global average. To deal with this exponential growth in demand, the individual members of the emirates, mainly Dubai and Abu Dhabi, are well ahead on their effort to build a strong electricity and water infrastructure.

**Exhibit 4: Production and consumption of electricity in UAE**



Source : World Bank

In Abu Dhabi, the Abu Dhabi Water and Electricity Authority (ADWEA) is responsible for the generation, transportation and distribution of water and electricity within the Emirate of Abu Dhabi. In Dubai and Sharjah, these tasks are the responsibility of Dubai Electricity and Water Authority (DEWA) and Sharjah Electricity and Water Authority (SEWA) respectively. The remaining emirates of Ajman, Ras Al Khaimah, Umm Al Quwain, and Fujairah are served, for the most part, by the Federal Electricity and Water Authority (FEWA).

The current installed generation capacity in the UAE is sufficient to cover current consumption, even during the peak summer season, when demand exceeds almost 92% of the capacity. A common challenge faced by the various utility authorities is that of sourcing sufficient quantities of natural gas to supply generation facilities during the peak summer months. Currently, all utility authorities are forced to rely to some degree on costly back-up fuel in order to meet summer power and water demand.

To cater to the future rise in demand, the authorities are going for public-private partnerships for utilities. Moreover, for better coordination and enhancing integration between the various electricity and water authorities in the UAE, the Emirates National Grid (ENG) project was launched by the UAE Ministry of Energy.

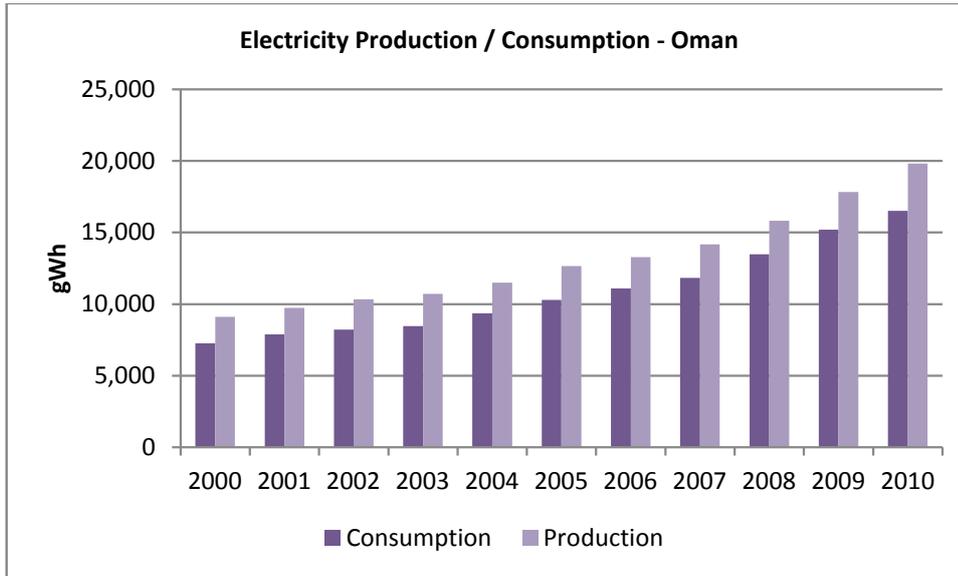
Approximately 97 per cent of the UAE's electricity production is fueled by natural gas, with the remaining three per cent produced by diesel generation and steam turbines. Several of the water and electricity authorities are studying ways to incorporate renewable energy, especially solar panels, to help meet the rising demand for electricity. For instance, the construction of the \$20 billion Barakah Nuclear Plant is well underway in Abu Dhabi. The first phase of the construction is expected to be completed by 2017. The project, being built by the Emirates Nuclear Energy Corporation, will produce nearly a quarter of UAE's electricity needs by 2020. This project would provide a boost to Abu Dhabi's energy supply as well as provide potential to export to other emirates. Another project, the \$1.8 billion Mirfa project in Abu Dhabi, is scheduled to be completed in 2015.

On the solar front, in March 2013, the UAE launched Shams 1, the world's largest concentrated solar power plant in Abu Dhabi, in a partnership led by Masdar with Total and Abengoa. Shams 1 is designed to produce 100 megawatts of electricity by focusing the sun's rays on oil-filled pipes for steam generation. On the other hand, in 2012, the DEWA launched the construction of the Mohammed bin Rashid Al Maktoum Solar Park in Dubai. The solar park is part of the strategy to Dubai's energy sources so that 1% of its power will be renewable by 2020 and 5% by 2030. The first phase of the solar park, which is expected to be completed by October 2013, will produce 13MW of solar power. The total projected cost of the solar project is \$3.27 billion and will generate 1,000MW power upon completion.

### *Oman*

The Oman Power and Water Procurement Company (OPWP) is the single Buyer of power and water for all IPP/IWPP projects within the Sultanate of Oman. Every year the OPWP prepares seven year projections for its water and electricity requirements. According to the latest seven year plan for the period 2013 to 2019, the country aims at sustained growth and development.

**Exhibit 5: Production and consumption of electricity in Oman**



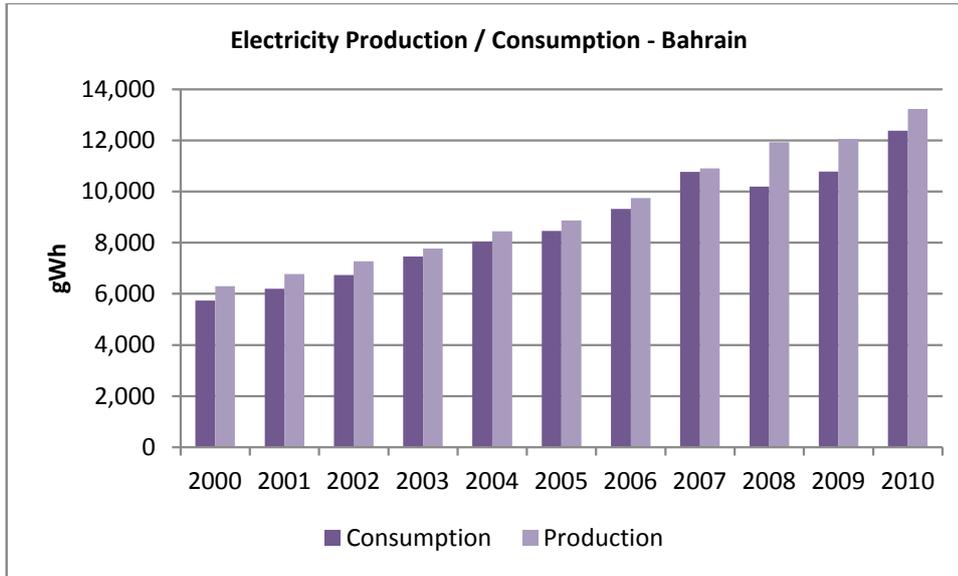
Source : World Bank

According to its latest projections, peak power demand for Oman’s central system, known as the main interconnected system or MIS, is expected to double from 4,293 megawatts in 2012 to 8,106 megawatts in 2019, representing almost 10% YoY growth. Peak water demand in Oman’s northern region is expected to grow from 218 million m<sup>3</sup> in 2012 to 316 million m<sup>3</sup> in 2019. The country is mulling the development of a 200-megawatt solar photovoltaic and concentrating solar power project; however, the project remains subject to government approval. Moreover, the construction of 16 power and water projects worth \$3.1 billion is slated to increase water desalination capacity in the country. One of the key projects in construction includes the Salalah 2 IPP with a planned generating capacity of 250 MW and around 10 million gallons of water per day. The project is expected to be completed by 2016. In another development, the Qatar Electricity and Water Company (QEWC) joined three other international partners to set up a 2,000-megawatt (MW) gas-propelled power plant near the town of Sur in the Sultanate of Oman. It will be the biggest green-field power project ever to be undertaken in Oman with its final commissioning in 2014. The power plant is expected to cost 700mn Omani rials (\$1.82 billion), with the first 433MW unit expected to be online by April 2013.

**Bahrain**

The Electricity and Water Authority (EWA) is responsible for the supply of electricity and water in the Kingdom of Bahrain. The country currently produces almost 4,000MW of electricity per day as against a consumption of nearly 3,000MW per day, resulting in a surplus production of 1,000MW of electricity per day. However, the country’s consumption is increasing at the rate of 10% per year. In order to meet future demand as well as to reduce current consumption, the kingdom has taken several steps. The construction of the \$2.1 billion Al Dur Power Project, which is expected to be completed by 2016, will help generate an additional 1,200MW to 1,500MW of power per day. The project currently produces 48 million gallons of water per day vs. a total country-wide production of 205 million gallons. Out of the total production, 150 million gallons is surplus production.

**Exhibit 6: Production and consumption of electricity in Bahrain**



Source : World Bank

The country is also upgrading its water transmission network and has spent almost \$41 million in the process. The project includes building of nine water pumping and distribution stations, expansion and rehabilitation of 12 existing stations, increasing storage capacity by 70 per cent to 215m gallons and replacing old water transmission lines in two governorates.

In one of the most radical steps for energy consumption, the EWA has launched a nationwide scheme to fit energy-efficient light bulbs at every home in Bahrain. The \$7.8 million scheme is expected to be completed within months and involves replacing about two million bulbs with more energy-efficient, longer-lasting and non-heating LED alternatives at no cost to homeowners. This is expected to reduce electricity consumption by at least 245 GWh annually. Several other measures currently being implemented includes thermal insulation in buildings, building rating system, green buildings, the standards and labeling of room air-conditioners, energy auditing and the continuous enhancement of energy efficiency in lighting. The kingdom has also announced plans to build a 5MW power station using solar and wind energy, which is due to be implemented in the next 5 years.

***GCC Interconnection Authority (GCCIA)***

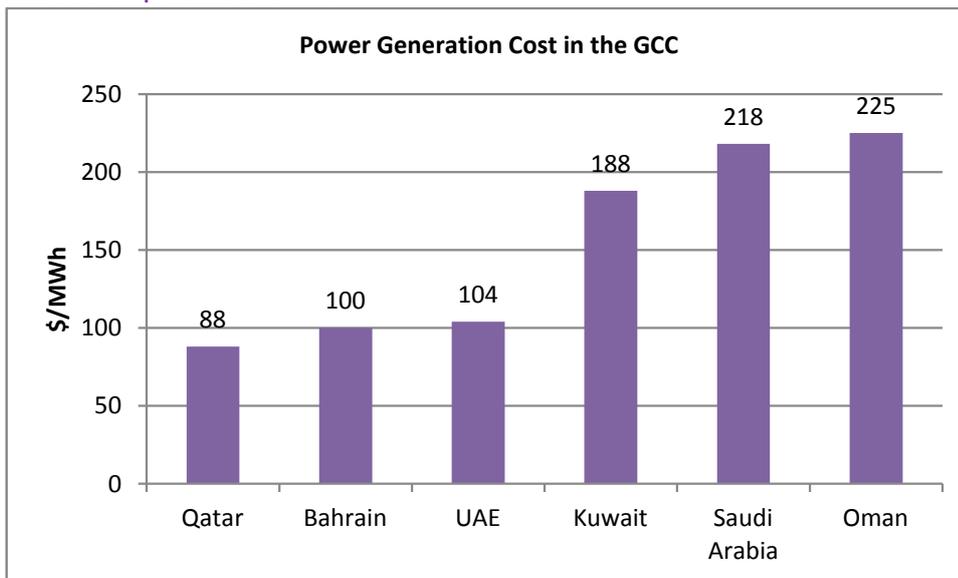
The four year old GCC electricity network, the GCCIA, is one of the first efforts in cross-border interconnection to share electricity. The project links the transmission networks of six Gulf states on one unified grid via overhead lines and submarine cables. The network has enabled energy sharing by members that have excess production of electricity with the ones with an undersupply. It is an efficient mechanism of sharing the critical resource at an acceptable rate, which would have otherwise required huge investments and high gestation period. According to the GCCIA, the GCC countries would require an additional 80GW of generating capacity by 2020 to meet the growing demand. However, with regional integration, the requirement goes down significantly.

A well established GCC electricity network could also enable exports of electricity to other external markets and boosting the negotiation power of Gulf States with importers as a unified body. There is a possibility of exporting it to European countries, leveraging on the difference in peak load periods between GCC and European countries. In addition to enabling energy trade, the network also helps reduce gas and fuel consumption that are required to generate this energy. The overall operating costs are also reduced through consolidation and volumes.

The authority has developed models for bilateral agreements making it easy for GCC states to agree on mutual business deals. This will enable GCC counties to get additional revenues out of the unused production as well as allow the other party to compensate any potential shortage of energy, and avoid power breakdown. Moreover, this will help countries to avoid the high costs of running the local production units with low efficiency, thus import energy from production units in another country with high efficiency and relatively lower costs.

According to E&Y, the grid alone will save GCC members up to \$3 billion in capital investment by avoiding the need to build more than 5GW of generation capacity over 20 years. Operational and fuel efficiency savings across the system will amount to at least \$300 millionm, based on feasibility estimates to 2028.

**Exhibit 7: Cost per MWh in the GCC**



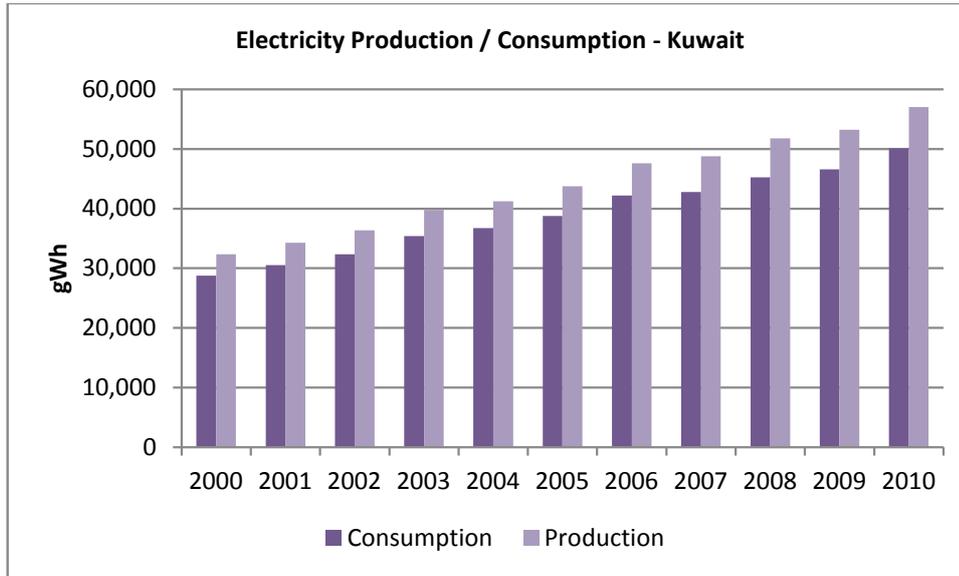
Source : ConstructionWeekOnline

Among GCC countries, Qatar has the lowest power generation cost at \$88 per MWh, while Oman has the highest cost of \$225/MWh. The Sultanate can reduce its cost to \$155/MWh by importing power from Qatar when the country faces power shortage.

**Utilities in Kuwait**

Kuwait’s Ministry of Electricity and Water is the sole authority that manages the generation/production, transmission and distribution of electricity and water in Kuwait. The authority heavily subsidizes the cost to the end consumer for these utilities, and consequently, these subsidies are one of the most important concerns for the government. The government’s electricity and water subsidies are as high as 93% of the original cost of manufacturing, resulting in total subsidies of KWD 2.6 billion per year. And with the expected increase in consumption of both these resources, the total subsidies are projected to be as high as KWD 9 billion by 2030. The country uses almost 300,000 barrels of oils per day for electricity generation. The consumption is expected to increase to as high as 900,000 barrels per day or 20% of its oil production by 2030, thus putting a dent on oil revenues of the country.

Exhibit 8: Production and consumption of electricity in Kuwait



Source : World Bank

Kuwait had a total capacity of 11 GWe in 2010. However, this is expected to grow to 25 GWe by 2030. Moreover, the country may face intermittent electricity shortages during the summer season. According to the Undersecretary Assistant for Planning and Training Dr. Meshan Al-Otaibi, Kuwait may face energy shortage during the summer of 2014 and 2015 if the projects aimed at increasing daily production at Subbiya power plant and the South Zoor power plant by 500 megawatts each as well as the construction of the North Zoor power plants are not implemented on time.

Kuwait also has plans to produce 15% of its electricity requirements from renewable resources by 2030. According to experts, Kuwait will need as much as 20% of its oil production for energy generation by 2017. Moreover, in order to reduce the consumption of oil for producing electricity, Kuwait is also considering increasing natural gas plants, both domestic and imported, for generating electricity and water desalination. Currently, natural gas represents for around 9.3% of Kuwait’s power generation capacity.

Although natural gas is a small fraction as compared to Kuwait’s oil reserves (63trn cu ft of proven natural gas reserves), Kuwait was never forced to explore its natural gas resources primarily due to the cheap and abundant availability of oil. However, with the increase in consumption of electricity and water, the domestic consumption of oil to generate electricity also increased. The opportunity cost of using oil to generate electricity as compared to selling it in the international market became too high for Kuwait. This has prompted the country to look at other sources for generating electricity, primarily natural gas, as it is fairly simple to use natural gas as in place of oil for generating electricity.

However, maintaining a continues supply of natural gas would be a challenge as Kuwait currently extracts less than 1% of its natural gas reserves annually. The best option is to import natural gas, which it does during peak summer season when the demand for electricity is at its all time high. The country is even planning to increase natural gas imports as it can sell the additional oil in the international market. According to Abdullatif Al Houti, managing director of international marketing at KPC, Kuwait sold an additional \$300 million worth of oil during 2010 by using natural gas for producing electricity. Kuwait is currently in talks with various international gas suppliers and is mulling at various options including gas pipelines and LNG. It also plans to increase its natural gas daily production to 4bn cu ft by 2030. The country is planning to invest \$100 billion in energy projects over the next five years, which includes plans to build a permanent floating LNG storage and regasification terminal to cope with its rising demand for gas.

On the other hand, energy saving initiatives is being undertaken by prominent corporates in Kuwait. E.g. Kuwait Oil Company is using solar energy in its oil fields, which provides almost 20% of power used in summer. The company is also planning to increase gas production, which can be further used to produce electricity. The company also has many power preservation initiatives through which it aims to provide 33MW of power to the national grid.

In addition, it has invited proposals for the first phase of a renewable-energy park as it plans to generate 15% of its electricity from sustainable sources by 2030. Only prequalified groups will be eligible to bid for the Phase I of the Shagaya energy project that will house 70 megawatts of renewable projects or 1% of its total production. The project will have a 2,000-megawatt capacity when all phases are completed and will save about 12 million barrels of oil equivalent a year. Phase I is scheduled for completion in the first half of 2016 and will be funded by the government. The second and third phases will produce 930 MW and 1,000 MW, respectively, when the project is completed in 2030.

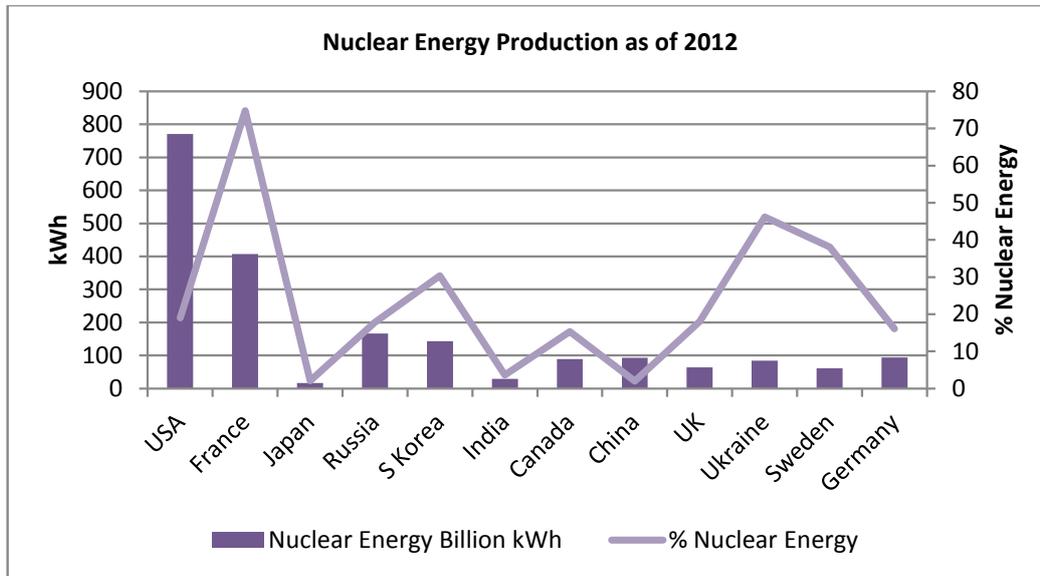
Kuwait also had plans to build nuclear plants to generate electricity. In March 2009, Kuwait announced its intention to establish a nuclear commission. Subsequently, in January 2010, the head of the National Nuclear Energy Committee announced a 20-year cooperative deal with the French Atomic Energy Commission for the development of nuclear power in Kuwait. However, in the wake of the Daiichi Nuclear plant breakdown in Japan in March 2011, Kuwait abandoned its plans to build four nuclear reactors by 2022.

## Nuclear Energy

Nuclear energy was once hailed to be the savior in order to fight back energy shortage across the world. However, after the Fukushima Daiichi nuclear disasters in March 2011, majority of the planned and proposed nuclear projects were put on hold, some even cancelled (in the case of Kuwait). However, countries are now reconsidering building nuclear power plants, with enhanced security features, complying with the strict international regulations relating to the construction, maintenance and disposal of hazardous substances. In December 2006, the GCC member countries announced that the Council was commissioning a study on the peaceful use of nuclear energy. In February 2007 the six states agreed with the International Atomic Energy Agency (IAEA) to cooperate on a feasibility study for a regional nuclear power and desalination program.

Among the GCC members, UAE has been the most active in developing regulatory framework and authority for the development of nuclear power energy in the country. In April 2008 the UAE independently published a comprehensive policy on nuclear energy. The country has plans to build four nuclear reactors with a total capacity of 5,600MWe by 2020. The construction of the Barakah I plant started in July 2012 and is expected to be completed by May 2017. Saudi Arabia also plans to construct 16 nuclear power reactors over the next 20 years at a cost of more than 300 billion riyals (\$80 billion). The first two are planned to be on line in ten years and then two more per year to 2030. These would generate about 20% of Saudi Arabia's electricity. The other members of the GCC are still at initial stages of planning.

Exhibit 9: Production and consumption of electricity in Kuwait



Source: World Nuclear Association

Internationally, the proportion of electricity generated by nuclear plants show a totally different picture. The percentage is as high as 75% in the case of France with a total of 58 reactors. The US produces 19% of electricity or 770kWh of electricity through nuclear energy with a total of 102 nuclear reactors. A number of reactors are under construction in countries China (28), Russia (10) and India (7).

### Conclusion

Being a rich group of countries in terms of availability of oil and gas, the situation in the GCC has not reached an alarming level wherein the countries are forced to resort cuts in the supply of power and water. However, unless the projects aimed at expanding the output of these critical resources are implemented in timely manner, it would be difficult for the countries to sustain the rate of economic growth. The formation of GCCIA is an excellent initiative made by the six countries that helps them in times of scarcity. Moreover, the massive planned investments in the solar sector would result in long term supply of cheap and sustainable renewable resources. GCC countries are also collaborating with the experts in the field of energy management are upgrading the efficiency of the power plants.

More importantly, apart from increasing the output, the GCC countries need to inculcate a sense of energy and water conservation among its people. The sky high consumption needs to normalize in line with global averages before any kind of policies and frameworks are implemented.

#### Recommendations:

**Improving efficiency of plants:** This is the first and the foremost step that the electricity distribution authority should do in order to improve the output of power plants. As pointed out by an official, the efficiency of Kuwait’s electricity plants can be improved by as much as 30%, which will have a direct impact in increasing energy output. There ways to reduce the cost of electricity in Kuwait. One of these ways is to set up a Heat Rate improvement Program using the method that suits co-generation plants. Incremental Heat Rate must be used to figure out which generating unit is most economical to serve the portion of the load increase. A Power Pool should be formed to determine the most economic way to serve any load in any area.

**Energy conservation programs:** Bahrain is the best example of an active program that will help educate the citizens and help in conserving energy. Other countries in the GCC should also have similar programs that help in cutting down the excessive usage of electricity and water.

**Reduce subsidies:** Globally, most governments make the amenities expensive to inculcate a culture of conservation. To avoid backlash, the government should do this in a phased manner, starting with mentioning the unsubsidized bill amount along with the subsidized amount. This will at least help in creating an awareness about how much the government subsidizes the bill.

**Separate rent and utility bills:** Combined rent and utility bills for rented houses is very common in Kuwait. The tenant ends up paying a fixed amount for utility services with no control over usage. This leads to excessive usage of both water and electricity with no sense of conservation. Separate rental and utility bills would greatly help in inculcating conservation habits among 2.8 million expatriates living in Kuwait.

**Smart Grids:** This is one of the most famous tools which is being implemented in developed economies to track household energy consumption. A smart grid is an electrical grid that uses technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity. The roll-out of smart grid technology also implies a fundamental re-engineering of the electricity services industry. Next-generation transmission and distribution infrastructure will be better able to handle possible bidirection energy flows, allowing for distributed generation such as from photovoltaic panels on building roofs, but also the use of fuel cells, charging to/from the batteries of electric cars, wind turbines, pumped hydroelectric power, and other sources.

**Use of technology:** The use of intelligent switches and smart applications is very limited in the GCC region. Simple technologies like automatic sensors for office lightning, energy efficient bulbs and appliances as well as energy efficiency grades for appliances can help to save tremendous amount of energy. Recycling and reusing waste water, as done in developed markets, can also help in conserving water to a significant extent.

**Use of Solar energy:** Kuwait gets the highest amount of solar radiation at about 8,000 W hr/m<sup>2</sup> followed by UAE and the Saudi Arabia. Moreover, the GCC region receives the highest daily solar radiation in the world. Solar holds the key to renewable energy development in the GCC region as it is the single most abundant renewable source of energy available there. Power produced from solar energy is efficient and cheaper as compared to other renewable sources of energy. Saudi Arabia has launched an ambitious plan to power street lights by solar energy. Similar plans can be implemented in Kuwait that can help avoid energy shortages. Ways to exploit the tremendous solar energy and other renewable energies like Fuel Cells should be considered and studied for their feasibility in Kuwait. Apart from the benefits of using renewable energy, power plants have adverse environmental and health impacts and lead to pollution. Such impacts need to be addressed, assessed and monitored.

**Green buildings:** A building rating system should be adopted for new construction of residential and office buildings in Kuwait. Certifications like LEED provide a suite of rating systems for the design, construction and operation of high performance green buildings, homes and neighborhoods. This is a common practice in developed countries and helps in saving significant amount of electricity and water.

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