

# Shifting Sands

## The UAE power sector enters a new era of diversification

The United Arab Emirates (UAE) is made up of seven emirates, yet two dominate the demographic, economic and geopolitical landscape. Abu Dhabi, the seat of central government, makes up 87% of the land mass and holds an estimated 94% of the country's proven hydrocarbon resources. The emirate of Dubai is home to the most populous and fastest growing city in the UAE, establishing itself as a global financial centre and tourist destination; successfully diversifying its economy away from its limited hydrocarbon resources, which now make up less than 6% of GDP.

The power sectors of Abu Dhabi and Dubai are currently undergoing a rapid and ambitious transformation spurred on by staggering growth in demand for electricity. Experts estimate year-on-year growth in demand for electricity in the region of 8 to 12% for the next 10 years. The main contributors are population growth and industrial development requiring a rapid and innovative response from the power sector. Abu Dhabi and Dubai retain relative independence for power generation, with each structuring and developing their sector to match their specific and differing needs. "Companies need to go through a separate registration process to

start doing business in each. In Abu Dhabi; it is not enough to be registered in Dubai," clarifies Pradip Kumar Das, GM of Gulf Jyoti International.

Abu Dhabi's power sector is the envy of many in the region. "Abu Dhabi has eight independent water and power producers (IWPPs) in operation, a nuclear organization in construction phase, solar and wind projects in place, and discussions about waste-to-energy and carbon capture and shortage. Where in the world has a framework like Abu Dhabi's? It is an absolute role model," says Mobin Khan, Power & Utilities sector leader at Ernst & Young.

Abu Dhabi's power sector is set up according to a single-buyer model, with Abu Dhabi Water and Electricity Authority (ADWEA) responsible for overseeing the sector through its subsidiaries: Abu Dhabi Water and Electricity Company (ADWEC), Abu Dhabi Transmission and Despatch Company (TRANSCO) and Abu Dhabi / Al Ain Distribution Company's (ADDC / AADC). Thus far independent power producers (IPPs) have been established with 40% of each plant being tendered to independent bidders, the remaining 60% being owned 90% by Abu Dhabi National Energy Company (TAQA) and 10% by ADWEC.

A view over Dubai  
from Burj Khalifa



Dubai, meanwhile, retains a much more bundled approach to power governance through the Dubai Electricity and Water Authority (DEWA). DEWA owns and operates 11 plants varying from 400 MW to 1,400 MW with a total capacity of almost 9,000 MW. DEWA has stated intentions to move towards an IPP model, however phase one of the first IPP project tendered was subsequently deferred, creating uncertainty over the future of such a model in the emirate.

Hassyan was to be Dubai's first partially private-owned power plant and through its six phases would have reached an impressive total capacity of 9,000 MW. The initial tender in 2009 was eventually deferred indefinitely in April 2012, DEWA stating officially that capacity would be made up through efficiency measures. Consortiums would have spent in the region of \$3-5 million preparing their bids, so a deferral at that stage would have been extremely disappointing for all those involved.

On the possibility of a Hassyan re-tender, David Charlier, partner at Ashurst commented: "Although the deferral was not ideal – and it will have dented bidders' confidence, many developers and lenders were enthusiastic about the opportunity to do the first IPP in Dubai so I suspect that if DEWA were to re-tender there would be interest. DEWA will need to consider how to address the concerns of potential bidders and to convince them that the project will go ahead."

A great deal of uncertainty remains on the future of the Hassyan tender and Dubai's IPP model in general. As Dubai's economy continues to grow and develop, there will be further requirements for increased foreign investment for the construction and operation of power plants.

The five smaller emirates, or "northern emirates" (Sharjah, Fujairah, Ajman, Ras Al Khaimah and Umm Al Quwain), possess minimal natural resources and are in a much earlier stage of industrial development. Each is seeking to build on core industrial sectors and encourage foreign investment to spur economic growth. Economic development of the northern emirates will result in an increasing demand for electricity, to which Abu Dhabi has committed to providing in the short to medium term through expansion and diversification of its own power sector.

## Generation: Diversification in motion

As it stands today, 97.5% of power generation across the country comes from natural gas-powered plants. However the next 10 years will see the introduction of a nuclear program in Abu Dhabi and the highly anticipated move towards renewable technologies, namely solar power, which holds huge potential in this desert environment. The push towards power diversification is in line with the strategy of industrial diversification away from fossil fuel dependence. For Dubai this will reduce the cost of liquefied natural gas (LNG) imports, while in the case of Abu Dhabi diversification will give greater opportunities for export of its remaining hydrocarbon resources. "The UAE might well have enough gas to last until 2030 or 2050, but it doesn't want to take the risk," says the regional manager of Hatch, Roy Dabbous on the push for nuclear power. "In the last four years, there has been good push to develop the more of the UAE's sour gas fields. These tend to cost more and require greater diligence when it comes to HSE" Dabbous continues.

### Nuclear

Abu Dhabi's nuclear program is the first nuclear project in the Gulf Cooperation Council (GCC), the political and economic union made up of Saudi Arabia, Kuwait, Bahrain, Qatar, Oman and the UAE. Abu Dhabi established the Emirates Nuclear Energy Cooperation (ENEC) in December 2009 to oversee the nuclear sector, beginning with the establishment of four nuclear reactors in the Barakah region of

western Abu Dhabi. The tender for the project was contested by a number of consortiums including GE-Hitachi, EDF-Areva and the eventual winners Korea Electric Power Company (KEPCO) with compatriot partners Samsung and Doosan. The first reactor is set to come into operation in 2017, with the fourth to be completed in 2020. Combined, they could make up as much as 25% of the emirates electricity capacity, providing the primary baseload of power demand. "Our project is today regarded as employing global best practice, so ENEC is being looked at as a role model. This is something to be proud of, but not complacent about: we have a long journey ahead of us," states Mohammed Al Hammadi, CEO of ENEC.

### Solar

Another key element in the UAE's forthcoming era of diversification is the highly anticipated adoption of renewable energies, namely solar power. The region's ideal climate for solar technology has been matched by the commitment of governments in Abu Dhabi and Dubai. The Abu Dhabi government, through its investment arm Mubadala, has established Masdar City to advance renewable energy and sustainable technologies through education, research and development, investment and commercialization. Along with regional offices for major players in the power sector such as Siemens and Boeing, Masdar City will also be home to the United Nations International Renewable Energy Agency (IRENA). "The main reason for placing IRENA's headquarters in the UAE was the country's dedication to renewable energy. Despite being rich in hydrocarbons, the UAE still has a very



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substantive and ambitious renewables agenda; Abu Dhabi has a 7% target for 2020, complemented by 5% in Dubai for 2030, and the Masdar Institute is growing into a globally significant organization" said Frank Wouters, deputy director-general of IRENA.

"Masdar City is concerned with the energy sector at large and we are specifically ambitious to be a growing important player in the renewable energy sector," explains Masdar's Bader Al Lamki,



Bader Al Lamki,  
Director  
Clean Energy  
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Matt Merfert,  
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Christopher  
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director of clean energy. Masdar is the major partner in the UAE's first major solar project, Shams One, a 100 MW solar park in the desert of Abu Dhabi, constructed in association with Total and Abengoa Solar. Dubai has also made its intentions clear with the announcement of the 1,000 MW Mohammed Bin Rashid Al Maktoum Solar Park, which began construction in late 2012.

A debate still runs within the solar industry about which technology is best suited to this market; photovoltaic (PV) or concentrated solar power (CSP). "There should, however, be space for both in the UAE; each technology is good, and people who talk about the front-end investment cost advantages of PV are taking too simplistic a view. What you should do is calculate costs across the 20-25 year life cycle of a power plant" suggest Tonjes Cerovsky, senior VP of sales in the Middle East and Africa region for KSB.

The 100MW Shams One project has chosen a hybrid CSP and gas model but when comparing the two technologies, Yousif Al Ali, general manager of Shams Power Company, suggests: "In 2008, CSP technologies were still cheaper than photovoltaic (PV); however, as a result of the financial crisis and large excess production capacity in China the price of PV dropped dramatically. Accordingly the generation of electricity from PV became very competitive, with electricity prices from PV now below those of CSP. If the dispatch-ability is not that important, companies will go with the cheapest technology, which at the moment is PV. When countries begin to increase the percentage of renewable energy in the system, they will need a reliable, dispatch-able source of energy, and thus they will initially need to go for a mix."

It is clear that this region should make full use of its ideal climate for utilising solar power. However, despite the year round sunlight and cloudless skies this harsh desert environment creates some unique challenges for solar installations. "This is not as good a place for solar power as the likes of North Africa, Australia and Chile, which have excellent direct sunlight, but it is the second best" points out Hamid Kayal, CEO of CSEM-UAE. "The main two concerns in the Middle East with regard to solar deployment are the high heat and dust, and our technology outperforms in both these aspects," explains Matt Merfert, project manager at First Solar, whose thin film PV modules have been chosen for phase one of the Dubai project.

"There is a clear advantage for thin film when it comes to utility-scale plants, and most of the new markets have large-scale plants. Less electricity is used to produce the thin film modules," adds Christopher Burghardt, First Solar's VP of business development, referring to the reduced time of energy payback from a more efficient manufacturing processes.

The market is flooded with solar-related firms positioning themselves to make the most of the highly anticipated boom in projects. Yet this has been the case for some years now, and the most significant obstacle to the establishment of solar projects remains: the lack of a regulatory framework in place to give confidence to both potential investors and the utility companies. However, there is a case to be made for patience. "Although the lack of regulatory framework is an obstacle to the development of the solar industry, rushing the process as in the case of Jordan results in a framework that many find overly complex, perhaps difficult to understand. The real challenge for the



Central Courtyard of the Masdar Institute Campus, Masdar City

UAE is whether it can create a regulatory regime to give the certainty to attract investment without it being overly complex and prescriptive," suggests Micheal Rudd of legal firm Bird & Bird.

### Clean Coal

Optimizing the extent of diversification is the construction of a clean coal plant in the emirate of Ras Al Khaimah by Utico in partnership with Shanghai Electric. The UAE has no significant coal reserves and as a signatory to the Kyoto protocol on CO2 emission reduction, the choice by Ras Al Khaimah for a coal power plant appears a little surprising at first. The 270MW plant is set

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to be completed in 2015 and, although yet to be confirmed, coal imports are likely to come from Indonesia. The project's success revolves around managing the plant's CO2 emissions through carbon capture and storage (CCS) technology. "The technology for carbon capture is no problem, but it is very expensive, reduces a plant's generation by 20% and requires the disposal of waste products; there is not a single commercially viable carbon capture and storage (CCS) project anywhere in the world, even for enhanced oil recovery" explains Richard Menezes, vice chairman and managing director of Utico.

With a unique combination of technologies Utico aim to achieve commercial viability of their CCS scheme by reducing operating costs and increasing the quality of CO2 generated. "Our project will capture CO2 at 98% purity, and we will further purify it to 99.99%, creating a premium product; we have already signed a deal for 200,000 tons per day with one of the biggest marketers in the Middle East," adds Menezes.

Achieving this level of success could see this clean coal model reproduced in other regions across the world on a bigger scale. Nearby Dubai has also discussed the potential addition of clean coal to their energy mix. "Dubai have made clear their intention to construct a coal power plant, Bechtel has conducted some initial research and a location has been decided but the availability of coal still creates some questions on how and when this will take place," states G.B.D Vara Prasad, operations manager at Pöyry.



Pradi K. Das,  
General Manager,  
Gulf Jyoti  
International

**Conventional**

Lars-Åke Kjell, regional director of power plants for Wärtsilä, explains: "To account for the fluctuations of renewable energy, you need plants which can start quickly. The peaks in the load system should be handled more efficiently than they are today."

Combined Cycle Gas Turbines (CCGTs) usually operate at an efficiency level of about 55%, with the efficiency dropping as low as 35% when its load is reduced

to 50% or less of the full power output. The paradox of environmentally-friendly solar energy is that it can often lead to conventional thermal units being run at part-load, varying their output according to solar production. They are then penalised by the laws of thermodynamics: they become less efficient and more polluting.

Power plants that run unevenly through the year have higher costs compared to similar plants that are run around



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the clock, all year long. So increasing the flexibility requirements for the conventional plants will result in higher operation and maintenance costs. Components will have to be replaced and maintained more frequently. However, this impact could be mitigated through more sophisticated and smarter lifetime management processes.

ADWEA and DEWA should be planning for the additional costs on conventional power plants used in a flexible manner, perhaps with capacity remuneration mechanisms such as those seen in more mature diversified markets. Major engineering and manufacturing firms active in the UAE are well aware of the issue, with such as GE's FlexEfficiency portfolio or Wärtsilä's gas engines utilising their Flexicycle technology aimed at reducing the impact. GE's general manager for thermal products and power generation, Mohammed Mohaisen, adds: "This is an oil-rich region but it is short of natural gas, the most valuable source of power generation. This is driving the need for efficiency and diversification."

### Energy Efficiency

Seasonal fluctuations in the UAE see significant disparity; residential and commercial demand experiences huge increases during the hot summer months through substantial use of air conditioning systems. Nick Carter, director general of Abu Dhabi's Regulation and Supervision Bureau, states: "Electricity demand was 10 GW at its peak this year, but for many months it falls as low as 4 GW, creating inefficiencies with idle assets."

Creating a power sector to account for these vast fluctuations is a great challenge for the UAE power authorities. Recent policies revolve around incentivising off-peak usage. "Everything comes under the caption of 'negawatts': we can, in effect, pay people not to use watts by giving them very cheap energy outside peak hours," adds Carter.

The emirates of Abu Dhabi and Dubai have some of the world's highest levels of electricity use per capita. Much of this can be attributed to the fact that 98% of water comes from desalination; a highly energy-intensive process exacerbating both residential and industrial electricity use. "Air conditioning and water are power-intensive, and at an outrageous 560 liters per person per day, here we see one of the highest levels of water consumption in the world," states Tonjes Cerovsky, senior VP of sales in the Middle East and Africa region for KSB.

Inefficient use of electricity is also an issue of great concern for these two largest emirates. "The UAE can no longer continue on this path where they are among the highest water per capita consumers, emissions per capita producers, kilowatt hour consumers and so on," claims Paul Navratil, Middle East energy, utilities and mining leader for PwC. In the case of Abu Dhabi, waste has been almost promoted by the low cost of electricity to consumers. The need for Dubai to reduce its consumption, however, is more pressing. "In Dubai, they have no alternative but to push for energy efficiency of consumption; they are



Goktug Gur,  
Country President  
- UAE, Oman &  
Pakistan,  
Schneider Electric

buying their electricity," explains Ahmed Sfar infrastructure business VP at Schneider Electric.

### Transmissions and Distribution

Efficiency of both usage and generation will be a key issue across the GCC and Middle East regions in the coming years. The region is now planning for an unprecedented level of cross-border power interconnection.

Physical connection is essentially complete but issues of economics and sovereignty are very much still in the discussion phase at the GCC Interconnection Authority (GCCIA).

"The GCCIA's ambition is to bridge all of the different regulatory regimes and create a commercial basis for moving and trading power. In addition, there could be the potential for exporting power outside the GCC," says Kenneth McKellar, Middle East energy and resources leader at Deloitte & Touche.

Long-term intentions are even further reaching, says Floris Schulze, MD of CESI, who are involved in establishing plans for a power trading market in the MENA region. "Part of what makes the project exciting is that the Gulf has the potential to be the powerhouse for the whole system, and potentially even for Europe and the Asia-Pacific, especially if it can make renewables more viable," says Schulze.

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Within the UAE the transmission and distribution network must keep up with the growth and development of the sector. The role of smart grids is central to balancing demand and supply in a diversified power sector. "Investments in distribution and generation must be synchronized and linked to the existing grid, with a focus on issues such as load-shedding," explains Goktug Gur, country president of Schneider Electric.

The transmission and distribution market is becoming very competitive in the build up to these necessary developments. However as Pradip Kumar Das, general manager of Gulf Jyoti International explains: "Most of the projects in the country set prequalification conditions; utility companies want to award the contracts to experienced contractors. Our challenge at the moment is our experience, and five years will give us enough time to build this experience and become the number one player in the region," says Kumar Das.

All the major players in the power sector are now present in the region and newer companies are flooding in year after year. "Abu Dhabi is mainly focused on cap-ex investment for new projects, Dubai on op-ex to improve existing systems. Dubai has also taken the initiative in solar power, while Abu Dhabi needs more property developments to make it attractive to migrants. The UAE is very challenging in terms of competition; the market is crowded with traditional companies as well as newcomers from the Asia-Pacific region," says Goktug Gur, country president of Schneider Electric.

Although we can be fairly sure that there will be a continuous stream of projects across the power sector, the competition will remain fierce for some time in such a congested market.

#### The future

The GCC sits on the cusp of a power revolution, with investments in the sector estimated at over \$250 billion in the next five years. The rest of the region will be assessing the success of the application of new energy sources, the balancing of a diversified power sector and perhaps most crucially the style of financial and regulatory regimes. The next five to ten years will be crucial in shaping not only the UAE power sector, but the GCC and the wider Middle East region.