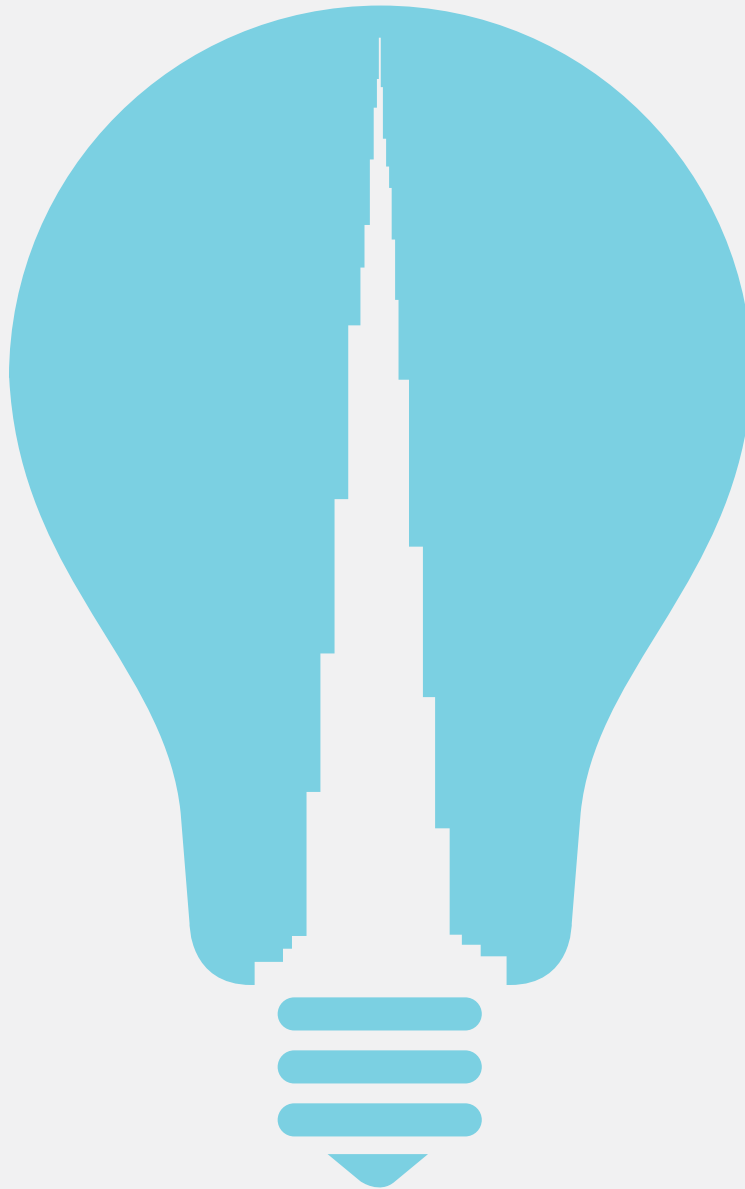


GLOBAL BUSINESS REPORTS

INDUSTRY EXPLORATIONS



UAE POWER

2013

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DUBAI OFFICE - Tel: + 971 4 2834 900 Fax: + 971 4 2834 901

Dear readers,



One thing we have learned during our time here is that very little is beyond the ambition of the UAE. The world's largest indoor ski slope situated in a desert city is perhaps the most striking, if slightly trivial, testament to that. In addition, the country is home to the tallest building in the world, the largest shopping mall in the world, the finest hotel in the world, not one but two world leading airlines and the most spectacular man-made islands ever constructed. All this and more in a country of less than 8 million people: a country just 42 years old.

Many within the Gulf state would attribute these advancements to the visionary leadership of the UAE. Again, in many respects they would be accurate. Sheikh Zayed Bin Sultan Al Nayhan set this "nothing is impossible" philosophy in action, ruling the UAE from 1966 till his death in 2004. His son now embodies that ambition, pursuing development in every direction.

There are also downsides to this philosophy. The race towards development in the power sector has resulted in rampant inefficiency. As the UAE power sector opens this new chapter, efficiency has been highlighted as fundamental to progression: it is the power plant they do not need to build.

Whether for nuclear, solar, efficiency or hydrocarbons, players across the global power industry are targeting the Emirates. The UAE acts as a hub for commerce in the Arabian Gulf and as a pioneer for new technologies, innovative regulation and best practice across the region.

This report is a patchwork of opinions from experts working in this exciting sector, combined with quantitative data and our own on-the-ground research. We would like to extend our sincere gratitude to all those who shared their insights and expertise with us.

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The first nuclear power station in the Middle East will be completed in Abu Dhabi's western region by 2020. Now home to the International Renewable Energy Association (IRENA), Abu Dhabi has built one of the worlds largest solar power plants: the 100 MW Shams One (Shams Two and Three are in the works). Meanwhile, Dubai has begun construction of the 1000 MW Mohamed Bin Rashid Al Maktoum Solar Park.

Katya Koryakovtseva & Ramzy Bamieh

Industry Interviews

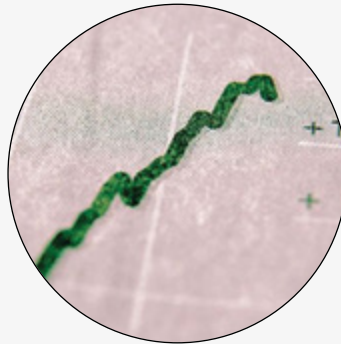
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This research has been conducted by Katya Koryakovtseva, Ramzy Bamieh, Alice Pascoletti and Diego Carrillo. Edited by Barnaby Fletcher | Designed by Gonazalo Da Cunha A Global Business Reports Publication For more information, contact info@gbreports.com, follow us on Twitter @GBReports or check out our blog at gbroundup.wordpress.com.

Beyond Oil and Gas: An Introduction to the United Arab Emirates and its Power Sector

"It is a combination of regulation and policy that makes the UAE very specific. Innovation and efficiency improvements are being promoted in a big way; the country wants the best processes and performance indicators. Clearly, Abu Dhabi's structure and regulatory capabilities are most advanced; Dubai has a regulator on paper but is still in the early stages of development. Abu Dhabi has a more unbundled framework; this is not an end in itself but independent regulation, accountability and performance improvement can lead to it. For some services, the northern emirates have been core business for DNV, but they are still highly dependent on Abu Dhabi for energy. As they mature, the first step will be to enhance knowledge through internal training."

- Mohamed Atif,
MANAGING DIRECTOR OF DNV KEMA MIDDLE EAST



A Tale of Two Cities

A brief introduction to the economy of the UAE

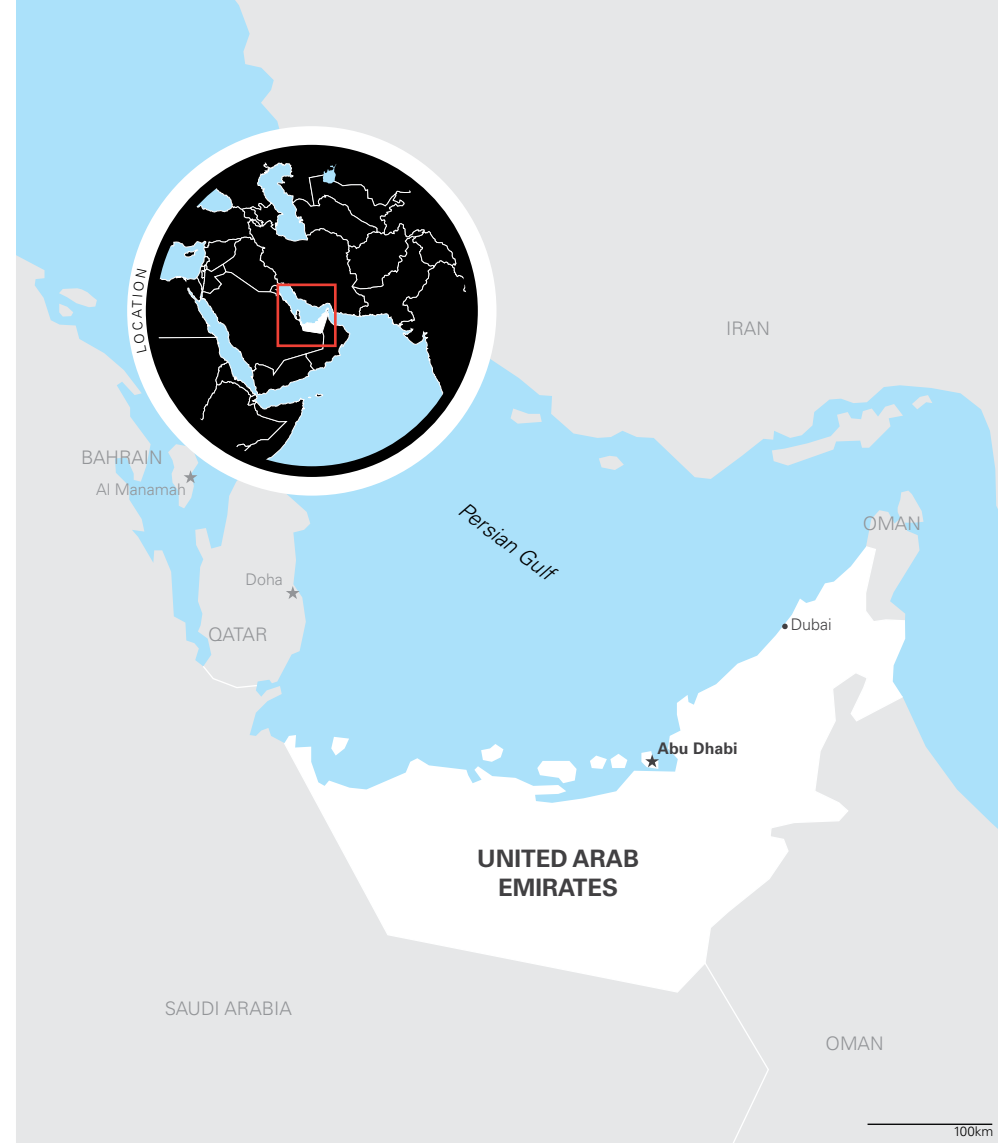
The United Arab Emirates (UAE) is made up of seven emirates, yet two dominate the demographic, economic and geopolitical landscape. Dubai, home to the most populous and fastest growing city in the UAE, has become a regional hub for the financial, retail, tourism, shipping and media industries, as well as a byword for extravagance and ostentatious wealth. 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.

Based predominantly on the strength of these two emirates, the UAE is in many ways the success story of the Gulf States. Even when encompassing those emirates outside these dual powerhouses, the UAE beats most of its regional peers in terms of GDP per capita (\$49,000 in 2012), which ranks as the second highest of the six Gulf States; surpassed only by the oil wealth of Qatar surpasses. The UAE can claim another strength: having reduced its dependence on its hydrocarbon resources to just 6% of GDP (according to some estimates), it can claim a more diversified economy than any other nation in the region.

This diversification has not fully protected the UAE from oil price fluctuations in recent years. The global financial crisis and the accompanying drop in oil prices struck the country a dire blow, dropping its economy into recession in 2009. The construction sites that had been a feature of Dubai for the past decade fell silent and stories abounded of cars abandoned at the airport as expatriates abandoned the city. Yet the resurgence of oil prices since have contributed to GDP growing by an impressive 5.2% in 2011 and 4% in 2012. Moving forward, growth is forecast at 5.1% per annum until 2016: an impressive figure for a country that already has the 12th high-

est GDP per capita in the world. This will be supported by the favourable conditions for foreign direct investment (FDI) in the UAE: the country ranks a respectable 26th in the World Bank's 2013 Doing Business report, having risen three places since 2012; Free Trade Zones offer 100% foreign ownership and zero taxes. After a significant fall in FDI in 2009 and 2010, 2011 showed a strong return, with FDI levels reaching \$10 billion. The Arab Spring, which disrupted growth for so many nations in the Middle East and North Africa region, could almost be described as a blessing for the UAE. Protests did not materialize on any large or organized scale (partly due to the comparative privilege of Emirati citizens). However, what little complaint

there was, including a petition to the government sent by roughly 100 Emirati activists and intellectuals, helped to spur a \$1.6 billion infrastructure investment plan for the poorer northern Emirates, which should in turn assist in further economic growth. Furthermore, the UAE is in a strong fiscal position. While slowly unwinding the stimulus package introduced during the global financial crisis, the central government has managed to maintain a budget surplus for three consecutive years. Inflation has remained at a low 0.9% in 2011 and 1.1% in 2012. This should give the government the financial flexibility to continue on the diversification and development initiatives it has carried out so successfully so far.



United Arab Emirates at a Glance

Source: CIA World Factbook

Population: 5,314,317 (July 2012 est)
Capital: Abu Dhabi
Chief of State: President Khalifa bin Zayid Al-Nahayyan
Head of Government: Prime Minister Muhammad bin Rashid Al-Maktum
GDP: \$361.9 billion (2012 est)
Growth Rate: 4% (2012 est)
GDP per Capita: \$49,000 (2012 est)
Economic Sector Breakdown: agriculture: 0.8%, industry: 56.1%, services: 43.1% (2012 est)
Exports: \$300.6 billion (2012): crude oil, natural gas, reexports, dried fish, dates
Imports: \$220.3 billion (2012): machinery and transport equipment, chemicals, food
Major Trade Partners: India, Japan, China, Iran

4.9%

GDP GROWTH RATE 2011

Source: World Bank

\$360.2451

BILLION

GDP
(current US dollars) 2011

Source: World Bank

1.1%

INFLATION RATE
Average Consumer Prices 2012

Source: CIA World Factbook

Regional Comparison: Gulf state rankings on the World Economic Forum's Global Competitiveness Report

Source: CIA World Factbook, Various

ECONOMY	2010/2011	2011/2012	2012/2013
Qatar	17	14	11
Saudi Arabia	21	17	18
UAE	25	27	24
Oman	34	32	32
Kuwait	35	34	37
Bahrain	37	37	35

Regional Comparison: GDP per capita in the Gulf states

Source: CIA World Factbook

	US DOLLARS
Qatar	\$102,800
UAE	\$49,000
Kuwait	\$43,800
Oman	\$28,500
Bahrain	\$28,200
Saudi Arabia	\$25,700

Population and Workforce information

Source: CIA World Factbook, Various

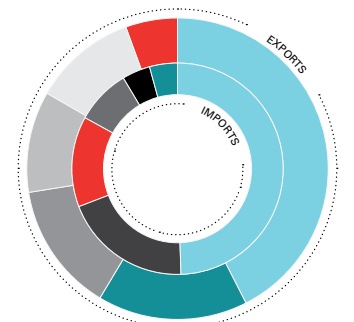
5,314,317
Population (2012)

3.4%
Filipino
2.4%
European



Exports and Imports (2011)

Source: EIU, Bank Audi



	EXPORTS	IMPORTS
• Others	42.6%	49.6%
• Japan	16.1%	3.9%
• India	5.5%	13.9%
• China	-	19.8%
• South Korea	14.0%	-
• Iran	10.9%	-
• Thailand	10.9%	-
• US	-	8.2%
• Germany	-	4.6%



INTERVIEW WITH

Kenneth McKellar

MIDDLE EAST ENERGY & RESOURCES LEADER
DELOITTE & TOUCHE

Could you give an overview of services offered by Deloitte to the UAE power sector?

Our core services are the key business lines of Deloitte: audit, and tax services (which are becoming important for businesses in the UAE) as well as consulting around strategy, operations, human capital and technology. We also provide a wide range of financial advisory services from forensics to supporting banks and clients with transactions. Our risk consulting business also covers a range of services from internal audit through to enterprise risk-management systems.

We talk about a UAE power sector but there a stark differences between each emirate. How do you compare the style and level of maturity in the different emirates?

Abu Dhabi and Dubai are equally mature in their own different ways. Abu Dhabi has established a strong model for incorporating the private sector, particularly on the power generation side. It is fair to say that Abu Dhabi pioneered this model in many respects. Both ADWEA and DEWA are at broadly similar levels of development, in terms of turning their utilities into businesses, comparable to the level of initial restructuring in the power sector that we saw in Europe some time ago. In the UAE and in many regions of the world authorities are learning from these developments in the West, and consequently this should speed up the rate of development here, especially on the regulatory side. This is in contrast to the oil and gas sector where most major foreign companies have long been present, and any contrasting levels of sophistication between the oil and gas sector on the one hand and the power sector on the other, are fast disappearing as we see, for example, the development of international partners in the UAE's nuclear programme.

We have seen an increase for demand of our services from the Northern Emirates, initially for our core services but moving toward a more comprehensive range that widely supports development in industry and commerce. The Northern Emirates may well be looking to the type of governance and regulation that already exists in Abu Dhabi and Dubai as they look to develop their own electricity networks.

How does the structure of the power sectors in other GCC nations compare to that of the UAE?

In some ways the power sectors of other GCC nations are as advanced as the UAE, with Saudi Arabia and Qatar for example currently in the phase of legal, financial and then commercial unbundling of their utilities. There is still some way to go for all the GCC nations to achieve this comprehensively, and it is essential to put a whole cross-border energy framework in place, with the regulatory aspect only one of its elements. There is still quite a lot of imbalance between oil & gas producers who produce heavy fuels for power generation and power generators themselves. Under the current systems those supplying the fuel can find themselves supplying fuel under long-term arrangements rather than spot, and therefore need to be compensated if delivering fuel at short notice or in an emergency.

What are the key factors holding up the pending interconnection of the GCC grid?

Although physically the grids are linked, the challenge is having all the cross-border regulation in place to secure a balanced portfolio of GCC-wide generation, whilst recognizing individual issues of sovereignty and ownership. Each nation has a growing demand for power throughout the GCC

and there needs to be an overall regulator to control power supplies overall. The real challenge is working more closely together across borders and getting a regulatory umbrella in place, which means overcoming political, economic and legal concerns. The GCC Interconnection Authority's (GCCIA) 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 GCC.

What do you consider to be key factors that will account for the increase in demand for electricity in the UAE?

Today, domestic per capital consumption of electricity in Dubai exceeds that of the USA. Dubai's Energy Strategy and other analyses suggest steep increases in demand for the next 20 years, with water desalination of course a significant element in that. However Dubai also aims to increase efficiency by about 30% through regulation and capital investment.

In the wake of the Arab Spring, whose effects were comparatively minimal in the UAE, the government made a concerted effort to develop education and healthcare systems and to invest in the northern emirates. This of course means an increase in electricity demand, in addition to the demands of continued growth in commerce in Abu Dhabi and Dubai. The overall theme, in the UAE and GCC, is to try and promote private industrial and commercial sectors separately from oil and gas. So when supply of hydrocarbons begins to decline this will provide a proper platform for commerce and industry. The key reason to have that in place is to create jobs. So this new demand is going to be fuelled by new industries, as well as an increase in domestic consumption. •

INTERVIEW WITH

Mobin Khan

PARTNER AND MENA POWER & UTILITIES MARKET LEADER
ERNST & YOUNG

The last few years have seen difficult economic conditions in the UAE and a reduction in merger and acquisition activity. Moving into the next five-year period, which services do you expect to be most in demand?

Primary focus will be on the capital agenda, operational excellence, strategic performance and assurance services.

One of the most important areas investors will be looking at in the next five years is innovative financing. Coming out of an economic crisis, attaining long term financing at good, cheap rates is going to require a very good business case. Questions will be asked about the markets to source the finance and credit worthiness and technical expertise of the investors.. Local knowledge is very important; although there is much information about the UAE in the public domain, smart investors will seek assistance with raising finance and evaluating return on investments. Entities like ADWEA and DEWA will continue to focus on studies to control electricity and water demand to include concept of smart metering. We also expect development of low carbon strategy to include assessment of current and future baseline scenario and developing policy framework. Other areas of focus would include improving performance and managing costs, implementing smart grid and energy efficiency concepts through new technology & handling customer's impact on new technologies and managing and controlling risk throughout the value chain. The Ernst & Young's Power & Utilities team has been successfully providing these services to the key stakeholders in the UAE and MENA region.

How would you compare the markets between the different emirates?

Abu Dhabi has been a role model for the UAE and the MENA region. Progress has been re-

lentless since 1998: there has not been a single year without a new initiative and ADWEA has been at the forefront of this drive. The results speak for themselves: Abu Dhabi now has eight IWPPs in operation, a nuclear plant under construction, solar and wind projects in operation, and discussions in progress on waste-to-energy and carbon capture and shortage. In summary, a true success story driven by visionary leadership of the late president His Highness Sheikh Zayed Bin Sultan Al Nahyan and His Highness Sheikh Khalifa bin Zayed bin Sultan Al Nahyan, the president of the UAE. The Abu Dhabi market also benefits from an independent regulator, the Regulation and Supervision Bureau tasked with the duty to enforce the relevant laws through the licensing of activities to various persons who undertake a 'regulated activity' in the sector.

Dubai, on the other hand, has shown growing desire to transform its power and utilities sector. DEWA's key challenge has been to manage the growing demand for power in the Emirate of Dubai and it has taken key initiatives to address the demand side management. The policies of the northern emirates are a little different. Abu Dhabi will play a leading role in providing power for the northern emirates. You will see fewer IWPPs being set up by those emirates in future, and increased investment from Abu Dhabi. With the seven "united" Arab emirates, leveraging off the foundations built in Abu Dhabi makes perfect sense.

After the deferral of Hassyan, where do you see the future of IPP models in Dubai? How will investor confidence have been affected?

Investor confidence is growing increasingly positive with the amazing turnaround in economic activity in the Emirate of Dubai. I do not believe the deferral of Hassyan is

going to have a lasting impact on the investor appetite for IPP models in Dubai. Under the visionary leadership of His Highness Sheikh Mohammed bin Rashid Al Maktoum, the Emirate of Dubai has shown a great resolve in overcoming its economic challenges and is now clearly on track for next phase of development and growth as evidenced by the announcement of a number of key projects in recent months. Investors are looking much more positively at the Emirate of Dubai today, and increased investment in power and utilities, potentially under an IPP model, are just a matter of time.

When do you anticipate the long awaited boom in the UAE solar market?

It is not easy to jump into a new form of renewable energy, but the success of early solar projects will bring about additional ones. Solar will be a good contributor of energy to the UAE in the next decade, but it cannot go from 2% to 20% straight away. This is a largely untried form of renewable energy in the MENA region. Challenges lie in understanding the long-term competitiveness, raising finance and evaluating return on investment.

If we return for the next report in five years, where will we find Ernst & Young in the UAE, and the power industry in general?

We are the only professional services firm in the UAE to have doubled in size over the last few years, and in the wake of the continued economic growth in the UAE, we expect this growth pattern to continue in the future. The power and utilities industry will certainly have celebrated the success of the first operations of the nuclear plant, renewables will feature more on the investor's agenda and potentially we may have our first carbon capture and storage project in place. •

INTERVIEW WITH

Paul Navratil

MIDDLE EAST ENERGY, UTILITIES & MINING LEADER
PWC

Could you tell us about PwC's services to the power sector?

PwC covers audit, tax, financial advisory and consulting. On the consulting front, the work we do is around two main areas: market strategy, focusing on providing information on the current trends and requirements and then projecting that over the next few years; the other covering operational effectiveness, which is vital in the region as companies and authorities strive to keep up with rising demand while also remaining profitable. This is true of the energy sector, covering oil and gas, power, and water, which are increasingly connected to one another. The more sustainable you are on the power and water side, the more efficient an oil exporting economy will be on the ability to monetize its oil and gas assets. Surprisingly, the connections between these sections of the power sector have been slow to be made in this region, and few examples can clearly point to the active coordination of the intersection and interdependence between these sectors.

How would you compare the legal and regulatory frameworks between Abu Dhabi and Dubai?

Consider ADWEA and DEWA; the mandate of these two companies is the same, however there are differences in the way they serve that mandate. DEWA is the monopoly player in Dubai, covering all sections of the power and water sector. Both DEWA and ADWEA have structured themselves to provide what is necessary for their respective emirates and I see no imminent change to this system. Efficient management of the power sector is increasingly at the forefront of their operations. Abu Dhabi has a variety of initiatives in place within its power sector allowing it to test and gain experience in each, capitalising what works best, including a num-

ber of independent projects such as Masdar and Emirates Nuclear Energy Corporation (ENEC) with the goal of creating a balanced and potentially more competitive power sector.

We are seeing estimates for power demand growth in the region on 7% to 10% year on year for the coming few years. What do you consider the main factors for this growth?

The main culprit is the blatant energy inefficiency on the demand side and if that continues we could be seeing even greater growth rates, which is when things can get catastrophic. It is down to society not having the proper awareness or being properly incentivised on these matters. In addition, the power and water sector are struggling to keep up with industrial diversification. In the top three issues facing industrial diversification is the efficient, reliable and timely electricity and water connection. Subsidies on power are a key root to the problems of inefficiency in this region, I see no significant change on this in the near future and it is a serious problem. Tariff strata are now being put into place but much more needs to be done in this regard, whether that be further tariffs, peak pricing or something else.

How is the diversification trend in the UAE power sector changing PwC's business model?

Significantly, look at ENEC for example, pursuing a nuclear program is great in principal but certainly challenging when there is a lack of depth in qualified Emirati nuclear engineers. It is a huge challenge for any company or country to embark on such a journey without having the full set of proprietary skills. This creates tremendous advisory opportunities for PwC, notably; capability building, organisational and opera-

tional structuring, strategy and so on. PwC has a world leading nuclear practice primarily based in the US and Europe to draw upon. With renewable energy we are conducting feasibility and market entry studies; exploring how the potential market will develop. Currently there is a lot of talk, perhaps too much talk on the renewable side without enough acting and we need to turn that corner very quickly.

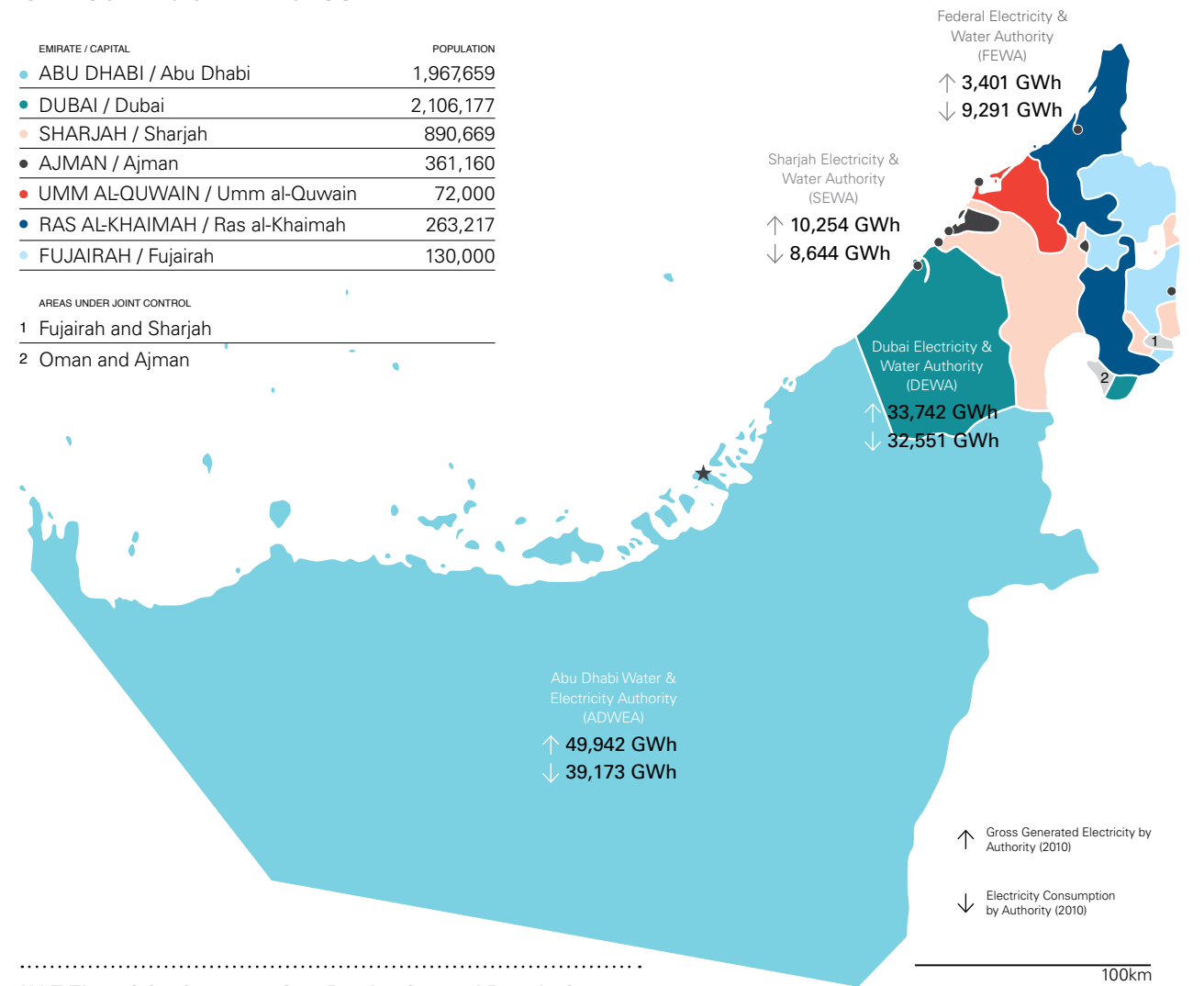
Where do you see the UAE power sector in 10 years from now?

Where the sector needs to be is really tackling the demand side management issue. My hope is that the work of advisors such as ourselves in addition to public campaigns and pressure from the oil and gas sector will lead to an environment of change. 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. There is an even bigger problem in the water sector, which goes hand in hand with power in this region. If the UAE deals with their water inefficiency they do a great deal in reducing power problems. It should not be a case of one organisation setup to solve all this, the nation and the sector needs to feel it in a big way in order to get the collective response that is required. There are two ways to reach that point, one is educating and becoming aware, the other is as a consequence of power outages and water shortages. The latter is not acceptable here: a power outage in July is the worst thing that can happen in this regard, yet we are not that far away from it. So my message is that there needs to be a strong focus on the way we use energy, managing the interdependencies between the power, water, oil and gas and other sectors of the economy.

United Arab Emirates

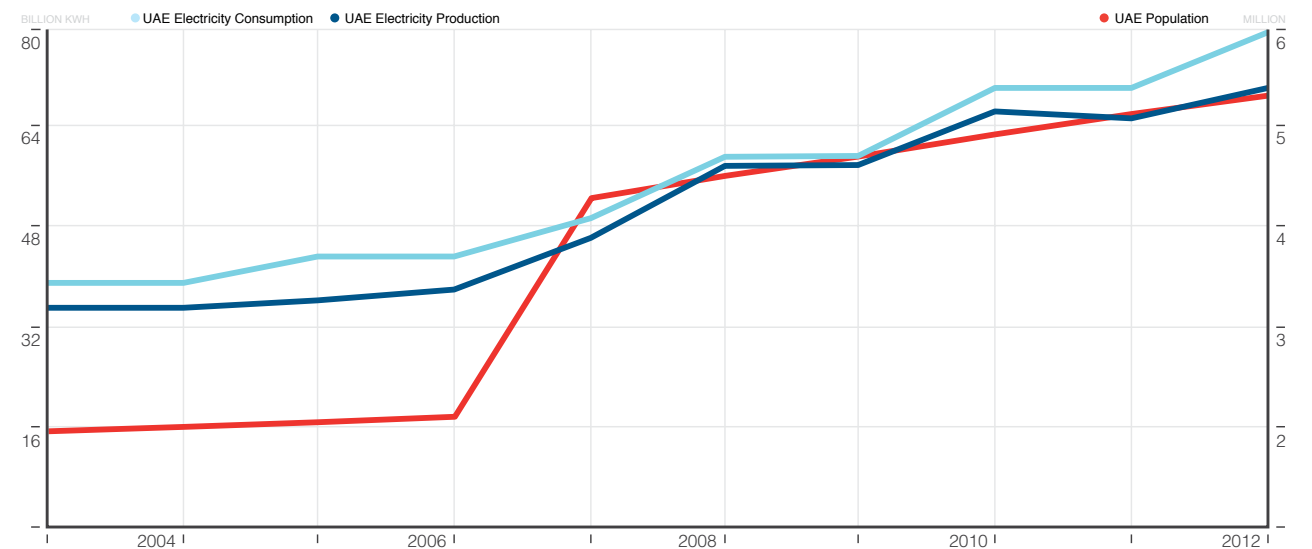
EMIRATE / CAPITAL	POPULATION
ABU DHABI / Abu Dhabi	1,967,659
DUBAI / Dubai	2,106,177
SHARJAH / Sharjah	890,669
AJMAN / Ajman	361,160
UMM AL-QUWAIN / Umm al-Quwain	72,000
RAS AL-KHAIMAH / Ras al-Khaimah	263,217
FUJAIRAH / Fujairah	130,000

- AREAS UNDER JOINT CONTROL
- 1 Fujairah and Sharjah
 - 2 Oman and Ajman



UAE Electricity Consumption, Production and Population

Source: CIA World Factbook





INTERVIEW WITH

Robert M. Bryniak

CEO
GOLDEN SANDS MANAGEMENT CONSULTANCY

There is a stark contrast within the UAE on government involvement and foreign investment in power generation. How do the different Emirates compare?

Almost everyone in the Gulf region has adopted a variant of either the Omani or Abu Dhabi models for procurement of power. Oman allows for 100% private ownership and participation, with no direct government or utility ownership, while Abu Dhabi uses private-public partnerships. There, the government gets involved through TAQA, which takes 60% of the project, while developers take the remaining 40%. How the remaining 40% is shared by the private sector is entirely dependent on the bidders; we are often seeing 20:20 splits due to the large capital investments required and levels of risk with the power project. The other key difference is that in Oman the project company must IPO within four years of setting up – this is to allow Omani nationals to participate and help develop Muscat's securities exchange. Both models have been extremely successful.

Dubai has tended to take the government standard procurement approach. Their attempt at the private sector route with Hassyan is not generally considered successful: they floated and then canceled the project, which discouraged many developers who spent millions of dollars preparing detailed technical bids and securing financing for the project. The issue in the northern emirates is a general lack of funding. As a result, several of them tend to rely on the financial support from Abu Dhabi. Sharjah, unfortunately, has not invested enough in either generation or distribution and has therefore experienced significant power blackouts and shortages over the last few years. The Federal Electricity and Water Authority, which has taken over the responsibility for power in the northern emirates, is largely supported by Abu Dhabi. A number of

projects have been initiated, and my feeling is that power shortages will be overcome in the next couple of years.

What does the Hassyan IPP cancellation mean for future bids? How likely is DEWA to repeat this, and would there still be confidence from bidders for projects in Dubai?

My guess is that companies would still bid on future IPPs or IWPPs, because returns are attractive enough, though there is a risk that DEWA may not get the same type of bidder, or quality of bid, as it might expect and it may have to provide guarantees that the project will indeed be awarded. Credibility is always an issue with IPPs, and in this respect both Abu Dhabi and Oman for instance have done extremely well: I am not aware of them failing to award any IPP or IWP that was initiated. Given Dubai's track record, it seems that they are not particularly interested in public-private partnerships. The municipal solid waste-to-energy project lead by Dubai Municipality was also never awarded, even though it was tendered and re-tendered. Part of the problem was the way in which it was designed. To be successful with public and private partnerships, I believe that government entities interested in public private partnerships need to take a more structured approach, and eventually award the contract to show they are serious; otherwise, private sector companies may not respond to future request for proposals.

Considering the UAE's economic development and population growth, what are your estimates for the growth of power demand in the UAE as a whole?

Power demand is likely to double by 2020. Compared to Europe and North America, where most countries are seeing just 2% to 3% growth, there is still a tremendous amount happening in the GCC countries. Qatar is get-

ting ready for the 2022 World Cup and there is a lot of construction in progress; Iraq and Saudi Arabia are also seeing huge expansion. This all affects Dubai and Abu Dhabi, where many of the engineering and legal firms are located. Much of the construction that took place here between 2005 and 2008 has now come to fruition, resulting in higher power demands and other projects put on hold three to five years ago are being restarted. Abu Dhabi and Dubai are projecting power demand growth of 8% to 9% per annum, but this could easily go to 12% or 15%: we saw Oman underestimate demand by a similar amount in 2012.

The low price of gas in the UAE affects the viability of renewables. Is the solution a reduction of gas subsidies, or the establishment of subsidies on renewables?

There is a general view throughout the Gulf that electricity, water and other utilities are social goods that should be provided for free, and prices have been kept low partly for this reason. In Abu Dhabi, for example, electricity is subsidized by about 85% for Emiratis, while expats pay much higher rates. It is therefore very difficult for governments to raise prices. In my view, none of the Gulf countries are likely to charge cost-reflective tariffs in the residential segment for the next decade or two, though higher rates may be introduced for commercial and industrial customers. It is the same with fossil fuels: raising the price to market rates, as economists suggest, could potentially lead to significant social unrest, as it would result in higher prices for many consumer goods and services. I think subsidies for renewables are the answer, as they have been shown to be very effective in countries like Spain. I would also encourage much more R&D in the area of renewables to help bring prices down further to more affordable levels for residential electricity users. •

Shifting Sands

The changing make up of the Emirati power sector



To make existence comfortable in what is, in essence, a harsh desert environment requires electricity. To build and maintain a city of the scope and scale of Dubai, which contains the world's tallest building, the world's largest shopping mall, and has announced plans for a new shopping mall that will break its own previous record, requires vast quantities of electricity.

Added to these monolithic construction projects is the simple fact that the population of the UAE is growing at a rapid pace. Indeed, the UAE's population growth rate of 3.06% is the ninth fastest in the world, surpassing even that of the much-heralded population boom in Africa. With an economic growth rate surpassing even the high population growth, the UAE's population is becoming increasingly wealthy for larger air-conditioned homes and entertainment, such as the already existing world's largest indoor ski slope, estimated to use over 1,000 MWh per year.

All this equates to a staggering growth in electricity demand. 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 and, in response, 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.

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.

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. •





INTERVIEW WITH

Nick Carter

DIRECTOR GENERAL
REGULATION AND SUPERVISION BUREAU

Could you provide a brief overview of the Regulation and Supervision Bureau?

Our primary duty, established with the backing of legislation, is the continuous provision of water and electricity for Abu Dhabi. The main functions are licensing regulated activities, defined by law as the production of water, generation, transmission and distribution, the sale of water and electricity, and waste-water collection, treatment and disposal. We do not regulate the gas sector or district cooling, but we cover everything in between. Another key duty is the regulation of monopoly companies from a price-control perspective; we undertake financial reviews of their expected future operating expenditure and capital expenditure, assess how well they have spent in the past, and set their maximum-allowed revenue. It is the same as the UK's system: price-control review periods are fixed at four years, during which time we do not interfere, and companies make or lose profits on the basis of how efficiently they are run. Generation and waste water PPP projects are competitively bid, so we do not financially regulate them. The Regulation and Supervision Bureau is currently involved in the structure of power-purchase-agreements for nuclear projects, and in determining the value of renewable energy projects. We look at fair value and then make sure these companies are able to deliver.

The UAE has been known for its overuse of electricity. Does the Bureau have a role to play in rectifying this?

The Regulation and Supervision Bureau does have a huge part to play in rectifying the overuse of electricity. We have set up two offices, Waterwise and Powerwise, focused on the provision of information to customers and the development of smart tariffs. Powerwise has installed meters in the villas of 400 social-

ly conscious national and non-national volunteers across the Emirates, which hypothetically charge different tariffs at different times of day; if this trial is successful, within a year we will be able to offer huge savings to large users of electricity for peak avoidance. There are a number of ways we can be imaginative: another possibility would be interruptible tariffs, where major users have parts of their electricity switched off at certain hours of day. We are running trials on interruptible AC units on five buildings here. 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. 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.

Another key piece of work is with the Emirates Wildlife Society in supporting a complete replacement of incandescent lamps by their LED counterparts, which can save 90% of lighting energy: the best way to do this will be simply to stop the import of incandescent bulbs through federal legislation. The development of LED technology in the last couple of years has been truly phenomenal, and it will get better and better.

A further area of interest is dynamic response. Because frequency is the same everywhere on a network at any voltage, you can program AC or refrigeration units to automatically trip if it falls below a certain level and other appropriate conditions are met. We would like to make this an ordinary feature of all AC and fridge type units sold here: as long as they are far through their duty cycles when they switch off, customers will rarely notice.

Some people have suggested 40% of the UAE's capacity could be covered by nuclear energy in future. At what stage is the current

programme, and do you see it being further expanded?

It is planned that four nuclear plants will be in production by 2020, generating a total of 5.6 GW. Power demand for Abu Dhabi and the four northern emirates is projected to be around 20 GW by then, so the nuclear program will contribute significantly. The bidding rounds have taken place on all four plants, although these are not issues we are necessarily privy to: the government makes decisions, which it is our job to support. Whether the nuclear program will be expanded further in future is a question I don't think anyone could answer. Nuclear energy could only reach 40% of the UAE's total capacity if it reduced its swing-load between summer and winter, which could only really be done by bringing in lots of industry which provides what are known as flat loads.

Will interconnection of the GCC grids have much of an impact?

The nuclear and renewable energy plants have to run 24/7 all year: it might be that some energy is exported either to Dubai or neighboring countries while they close down plants in winter. Those discussions are yet to happen, however, and there is no hurry for them just yet. We have studied the transmission system extensively and know it will not need a fantastically huge investment to further integrate Abu Dhabi with Dubai; we have the Emirates National Grid in any case. But we only have one link to the GCC, with firm capacity of just 1.2 GW, which is no big game-changer. •

Challenging Diversification

To meet massive increases in power demand, the UAE has chosen diversification so as to assure energy security and to save hydrocarbon resources for more lucrative export. The introduction of nuclear power creates a reliable base-load power supply with minimal CO2 emissions but inflexible electricity production. While the highly anticipated push towards solar power, in this ideal climate, will provide cheap, clean electricity but is susceptible to fluctuations beyond anyone's control.

This new era in the UAE power sector will place new demands on conventional power generation, which currently makes up 97% of electricity generation in the hydrocarbon rich Arab state. With a nuclear base-load, conventional power plants will be required to mitigate the fluctuations of solar power by providing a flexible and dependable source of energy. Global players in the field of conventional energy are reacting with innovative solutions, which will be essential in the rapidly growing and diversifying Middle East markets.

It is expected that electricity demand in UAE (and some other GCC countries) will grow by 8-10% year on year for the coming decade due to population growth, commercial-industrial expansion and then further exacerbated by the need for water supply through energy intensive desalination processes.

Seasonal fluctuations see significant disparity with residential and commercial demand seeing 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 explains: "Electricity demand was 10 GW (Giga-watts) 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. Carter adds: "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".

The emirate of Abu Dhabi has undertaken an ambitious nuclear energy program as one path to meet this demand. Emirates Nuclear Energy Corporation (ENEC) was established to oversee the construction and operation of the Middle East's first nuclear power plant in the Barakah region of western Abu Dhabi. The four units being developed by the Korea Electric Power Corporation (KEPCO), set to be completed in 2020, will make up as much as 25% of electricity capacity in the emirate. Nuclear power plants for all their positive characteristics are incredibly inflexible in their supply of electricity. They have a technically mandated minimum down time of approximately 15 to 24 hours, and it takes up to two days to get them up and running again. Abu Dhabi's nuclear program will make up the base-load in the emirate's supply.

The other key element of this diversification plan is the highly anticipated influx of solar power, primarily through a program of large solar parks. Due to abundant and costless sunlight, it is a fair assumption that electricity from solar power will be given a guaranteed priority for feed-in into the grid. However solar power production varies greatly due to the weather or time of day. As a result of this, there is a growing need for flexible conventional power plants, which can cover the fluctuating residual load.

Gas and light oil – conventional power plants currently meet approximately 98% of power demand in the UAE. Whilst traditional variability of demand has always required a

certain amount of flexibility, power ramps from renewable energy will introduce a steep change in the way the power systems are operated. Firstly Combined Cycle Gas Turbines (CCGTs) usually operate at an efficiency level of about 55%, the efficiency drops as low as 35% when its load is reduced to 50% or less of the full power output. So we get a paradox where conventional thermal units that are run at part-load, varying their output according to solar production to maintain safety and stability of supply, are penalised by the laws of thermodynamics. They become less efficient and more polluting.

Secondly, power plants that run unevenly through the year have higher costs compared to similar plants that are run around the clock all year long. Increasing the flexibility requirements for conventional plants will result in higher operation and maintenance costs. Components will have to be replaced and maintained more frequently. However, the impact could be mitigated through more sophisticated and smarter lifetime management processes.

The electricity authorities in the UAE need to consider the additional costs on conventional power plants used in a flexible manner and offer capacity remuneration mechanisms such as those seen in more mature markets. Other important factors, which could help mitigate this problem, include the role of smart grids in balancing demand and supply from different sources. The issue of demand side management is also crucial in reducing reliance on conventional power plants. In addition the role of cross-border interconnection in 'smoothing' fluctuations could be another way of solving these issues, but is very much still in the discussion phase at the GCC interconnection authority (GCCIA). These points are beyond the scope of this article but will be explored in our upcoming report. •

Cleaner, Greener, Smarter and Nuclear: The UAE Power Sector Enters an Era of Diversification

"Abu Dhabi plans to generate 7% of its electricity from renewable sources by 2020, while Dubai is looking at 2% by 2020 and 5% by 2030. So the journey has started and what is most exciting is that the UAE has taken the first step in this part of the world. Saudi Arabia is now establishing very ambitious plans, the same can be said of Kuwait, Morocco, Jordan, Egypt and so on, which is great to see us all heading in the same direction with the UAE leading the way in many regards."

- Bader Al Lamki,
DIRECTOR OF CLEAN ENERGY AT MASDAR



Changing Focus

A breakdown of electricity generation in the UAE

Petroleum is the bedrock of the United Arab Emirates' economy, and forms a similarly dominant foundation in its power sector. Today, 97.5% of the 90.48 TWh of electrical generation across the country comes from natural gas-powered plants, fed by the UAE's 6.089 trillion cubic meters of natural gas reserves, the eighth largest in the world.

Yet the massive investment forecast for the UAE's power industry in the short to medium term (\$25 billion over the next eight years, according to a recent report by the Kuwait Financial Centre, Markaz) is not all pouring into the hydrocarbon sector. Of far more interest to investors looking to take advantage of the expected 8% annual growth in the sector until 2015 is the country's potential for renewable energy generation, smart grids, and the entire non-oil section of the power spectrum.

The next 10 years will see the introduction of a nuclear program in Abu Dhabi: by 2020 nuclear energy is planned to contribute 7% of the country's total power demand.

The highly anticipated move towards renewable technologies has also begun in earnest, with landmark projects including a 1,000 MW solar park unveiled in January 2012. The famous Masdar City, designed to be a model of an environmental city, is now home to a renewable energy research hub, home to roughly 150 energy companies.

This 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".

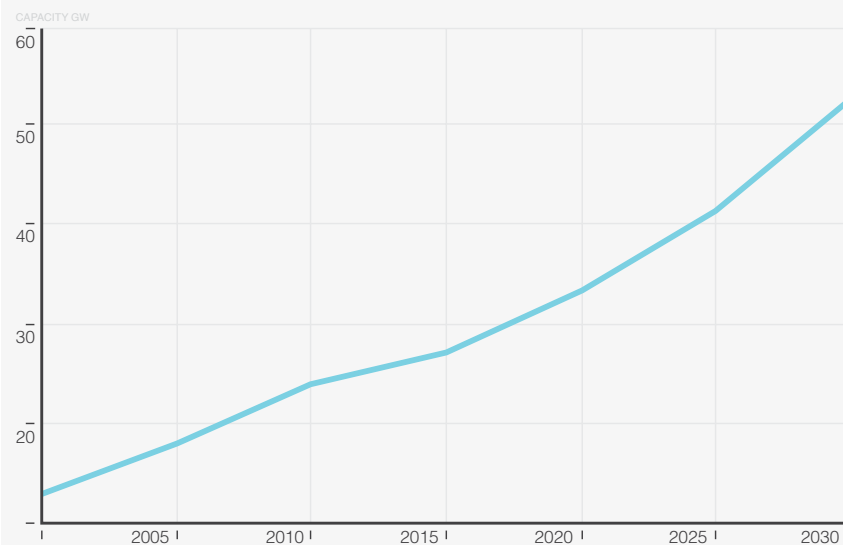
The opportunities that this growth and diversification brings have made the UAE a focus for companies such as German manufacturer active in the oil and gas and energy sectors. "In the current global economy, the Middle East is Weidmuller's highest-priority region," explains Gupreet Singh, regional sales manager at Weidmuller. "In the last year, leading figures in the company have shown interest in flying out here to meet customers. We have experi-

enced double-digit growth in the region and would like to repeat this for the next three years; this is also a profitable place to operate. In five years, all the solar plants will be up and running, and we will be entering the nuclear phase."

The excitement from investors is a good indication of the promise of the UAE's power sector, yet also a cause of challenge. "Apricum is convinced we will see some first tenders in Saudi Arabia this year, and the overall mood of the industry will improve. The word is that initial tenders will also be on the table in the UAE in 2013. Competition will definitely be high; the market is oversupplied, with a strong challenge coming from China... The industry is in a consolidation phase, which is bound to continue this year as prices remain low," explains Niklai Dobrott, managing partner of consulting company Apricum.

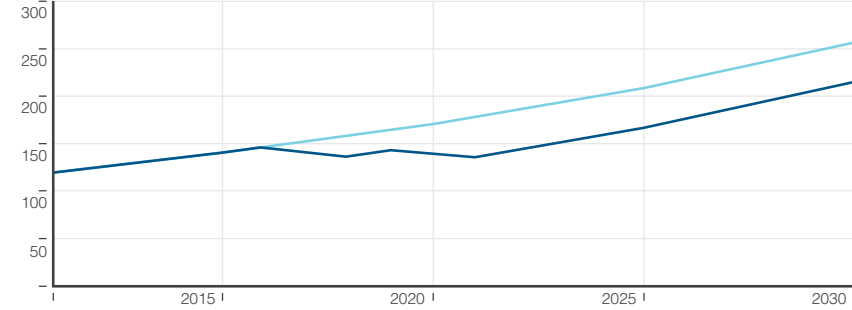
Electricity Capacity Forecast

Source: EU-GCC Clean Energy Network



Projected Energy Composition

TWh - ELECTRIC

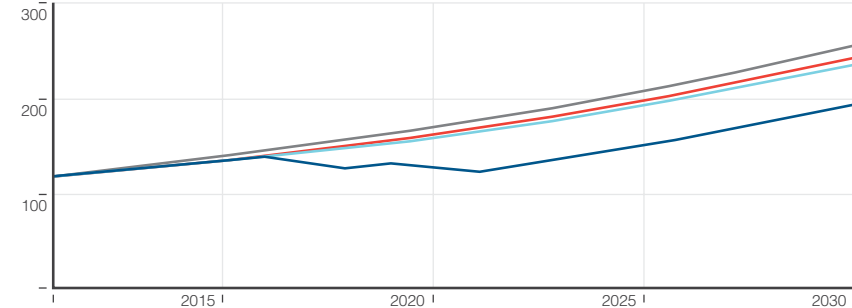


Under Current Policies

Source: EU-GCC Clean Energy Network

● Fossil Based
● Low-Carbon Energy (Nuc, CCS)

TWh - ELECTRIC

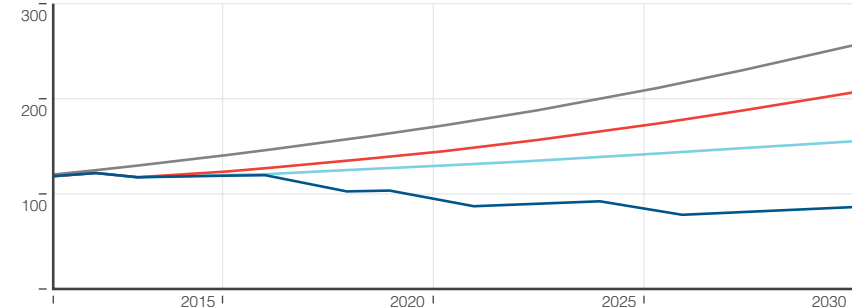


Under Current and Announced Policies

Source: EU-GCC Clean Energy Network

● Fossil Based
● Low-Carbon Energy (Nuc, CCS)
● Renewables
● Efficiency Gains

TWh - ELECTRIC



Discussed Ambitions

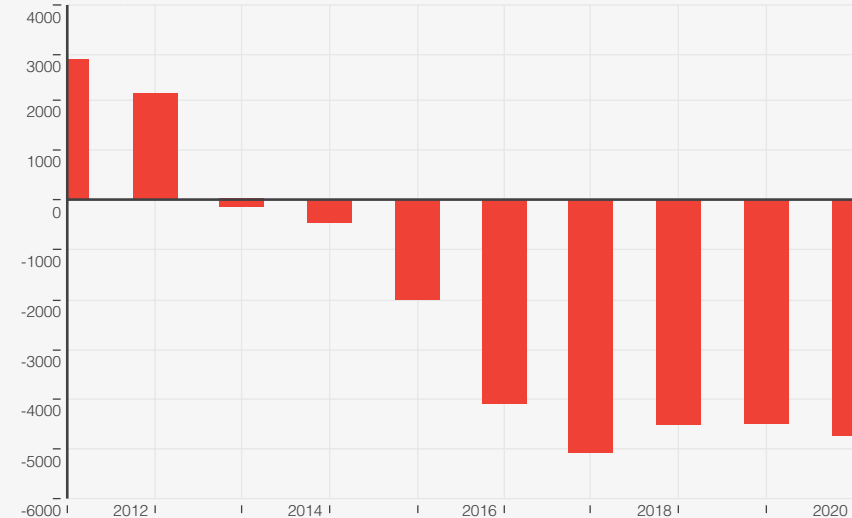
Source: EU-GCC Clean Energy Network

● Fossil Based
● Low-Carbon Energy (Nuc, CCS)
● Renewables
● Efficiency Gains

Planned Capacity versus Forecast Consumption

Source: EU-GCC Clean Energy Network

ELECTRICITY GROSS MW



Existing Power Stations

Source: various

NAME	GENERATION	TYPE
Shuweihat 1 IWPP	1,615 MW	Thermal
Shuweihat 2 IWPP	1,627 MW	Thermal
Shuweihat 3 IWPP*	1,647 MW	Thermal
Taweelah A1 IWPP	1,671 MW	Thermal
Taweelah A2 IWPP	760 MW	Thermal
Taweelah B IWPP	2,220 MW	Thermal
Al-Awir	1,834 MW	Thermal
Jebel Ali	6,888 MW	Thermal
Fujairah 1 IWPP	861 MW	Thermal
Fujairah 1 IWPP	2,114 MW	Thermal
Umm al-Naar IWPP	2,430 MW	Thermal
Shams 1 IPP	100 MW	Solar

*full production planned for 2014



INTERVIEW WITH Bader Al Lamki

DIRECTOR OF CLEAN ENERGY
MASDAR

What is your view on the trend towards energy diversification currently taking place in the UAE?

This part of the world has long been a major contributor to the global energy sector, be it through the supply of fuels such as oil and gas or by building capacity for electricity generation. The UAE has been blessed with a leadership who have a long-term vision. As the UAE continues to develop into the next decades and the next century, the demand for power also develops through population, industrial and commercial growth. There is also a strong link between demand of energy and water in this part of the world with 97.5% of current water supplies coming from desalination, which depends on thermal power plants. This development calls for both demand side management and diversification of the energy mix. By diversifying you are not only ensuring energy security but also ensuring the sustainability of our prime fuels while creating opportunities for the export of those fuels now and in the future. If we look at the emirate of Abu Dhabi; gas will retain a strong influence on electricity generation, the safe nuclear programme will take up its proportion of the energy mix and they have setup Masdar to be its arm in developing renewable energy both locally and internationally.

In terms of demand-side management, a number of initiatives have been established, among them is the Green Building Code whereby new buildings must abide by certain regulations promoting efficiency in energy and water.

Masdar currently has Shams 1 active and set to expand, Noor 1 and Sir Bani Yas developing. How much do these plans go to achieving that 7% target for renewables?

In 2020 we will be looking at a total capacity in the region of 22 to 23GW, meaning the

scope for renewables will potentially be in the region of 1,500 to 1,800MW. So there is a need to do more and we are marching toward that goal in a way that is cautious, and coordinated in conjunction with developments in technology. Year on year we continue to re-prioritise the renewable energy resource, aligning with the stakeholders involved who will all need to be involved to help achieve this target.

We know the potential for solar power in the region, perhaps more than any other region. How do you consider the significance of wind power in the region?

The potential is there for wind power to be part of the selection of renewable energy sources that we need to tap into. The GCC region however has been blessed twice, we have resources under the ground in the form of oil and gas but also blessed with abundant sun. The obvious pick with renewable energy would be one that involves solar thermal (CSP) or PV. Wind is of course location specific, we do consider there to be areas with potential to generate wind energy in the UAE but small in comparison to solar. Having said that we still see merit in pursuing wind power technology not only to attain the knowhow for local generation but also to give us a stronger platform to engage in more wind power projects internationally, such as in Morocco, Egypt and Jordan. In addition Masdar has been involved in the world's largest offshore wind farm with the London Array in the UK, which started producing electricity in October 2012. Masdar is a commercial enterprise and we will embark on those projects, be it solar or wind, where we see potential for commercial returns for us and our shareholders.

On Masdar's international projects, namely the London Array and Gemasolar in Seville,

what role is Masdar playing in these projects and how profitable are they?

Masdar is a commercial enterprise and we screen projects for technology risk, partners risk, potential returns and project execution. We have world-class criteria for selection of these projects giving us a taste of being an international serious player in this sector. For the London Array we have played a significant role in the project development phase in addition to collaborating with the partners on the power purchase agreement with the UK government. The London Array is a true demonstration of a large-scale renewable project which is commercial.

Gemasolar is the first solar power plant that runs for 24 hours a day by utilising CSP and heat storage technology. Valle 1 & 2 are also CSP plants but using the parabolic trough system and some storage capability. They produce 50MW each, while Gemasolar produces 20MW meaning these three beautiful power plants constitute 120MW.

Along with these major projects, Masdar is also involved in projects in Mauritania, Tonga, Afghanistan and the Seychelles. Could you tell us a little more about them?

While we are primarily an institution to deliver the large-scale projects, with our expertise and credible track record, the UAE government have entrusted us with supporting special projects in those regions. This is in some way connected to Abu Dhabi's successful bid to host the International Renewable Energy Agency (IRENA) which will be based here in Masdar City. It is the first UN agency based in the Middle East and will bring the attention of the world to the region and renewable energy. •



INTERVIEW WITH Frank Wouters

DEPUTY DIRECTOR-GENERAL
INTERNATIONAL RENEWABLE ENERGY
AGENCY (IRENA)

Could you tell us more about IRENA: its mandate and operations.

IRENA is the only truly global organization dedicated to advancing renewable energy. We have near-universal membership: more than 100 countries, plus the EU, are full members, and including others that are in the process of joining we are now supported by more than 160 countries. This gives us tremendous convening power and the mandate to be the global voice for renewables, something which was missing before IRENA was set up. We are a global hub for technology and policy debate, and are able to help countries implement specific action, which has been very successful in recent years.

Was there any significance in choosing Abu Dhabi, at the center of an oil-rich region, as the headquarters for 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 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.

How can IRENA work with the UAE to help it meet its targets?

IRENA is partnering with the Masdar Institute on its Global Atlas, a GIS-based online platform providing a quick but detailed overview of the potential of renewables. So far we have developed the atlas for solar and wind, normalizing the available data to make it usable, and next year we will expand it to include biomass and geothermal energy. Next year we will also be working on targets – what they actually mean and how they are embedded in the regulatory framework. Announcing

a target is extremely important, but a lot of detailed behind-the-scenes work then needs to be implemented; financial mechanisms and legal and institutional frameworks need to be aligned. Having worked with countries around the world, we have a unique understanding of what does and doesn't work – if you are new to renewables, it is of great help to work with IRENA.

The UAE's targets are very ambitious. What does it need to do to meet them?

Meeting your targets all boils down to having the appropriate regulatory framework; it really goes down to the specific details. I have no doubts about the feasibility of the UAE's targets. Solar power can be developed faster than anything else: Germany installed the equivalent of six coal-fired power plants in the space of a month just through individuals putting panels on their roofs.

Germany achieved success through bringing in private investment. Do you see a similar system working in the UAE?

You can tap into the private investment of individuals and local banks by including a feed-in tariff for smaller distribution. For this to work, though, the solar sector needs to be subsidized to the same extent as other power sources. I don't necessarily agree that there is more opposition to feed-in tariffs in Dubai than Abu Dhabi. On the contrary, Dubai has an extra incentive from no longer having fossil reserves; it is now buying quite expensive fuel.

For solar power to take off, it needs to become economically viable. What role should the government play in incentivizing it?

A combination of technological progress and government support is needed. The Masdar Institute is a great example of an organization

working to reduce the cost of solar power. The only ways to improve efficiency are through innovation, supply chain management and scale, the last two of which only happen when you actually build things. PV cells will continue to follow a normal cost-reduction curve. They have fallen in price by 60% in the last two years, and can already compete with LNG and burning diesel in a place like this. The Dolphin gas supply from Qatar is limited, and demand is growing. Unless they build another pipeline, it will not be enough – and I am sure the next contract will reflect current market prices.

Masdar has won international acclaim for its work. How significant is its innovation and vision?

Nobody else is building anything like Masdar City. There is much talk about its slowdown, but there is no lack of commitment: the project just had to adapt to the local real estate environment. The entire world looks different today from 2007, and the current level of ambition is much more realistic. If you can make this type of project work in Abu Dhabi, it shows you can make it work anywhere.

Where can we expect to see IRENA five years from now?

IRENA is the global voice for renewables, so people will listen to us and continue to use us as a hub for information exchange. In five years, we will have a substantial portfolio of services in terms of training, policy advice and overviews on cost and standardization. One of IRENA's challenges is showing people renewables are much more competitive than they realize, because change is so rapid. Watch this space. •

INTERVIEW WITH

Mohammed Mohaisen

DIRECTOR-GENERAL - THERMAL PRODUCTS & POWER GENERATION SERVICES SALES
GENERAL ELECTRIC

Please provide an overview of General Electric's power and water division.

General Electric (GE) provides an array of energy solutions and power technology processes. We are involved in the conventional power, wind, solar, biomass and nuclear sectors. There are synergies with our water treatment and desalination capabilities, which are why we have combined the two utilities under one unit. It receives \$30 billion of annual revenue and employs 100,000 people in more than 100 countries. We are proud to generate 25% of the power on the world's grids.

Our UAE story began in 1975. We provide 30% of the UAE's generated power, including most of Dubai's, and employ 400 people here. We have developed relationships within the public and private sectors across the UAE. In Dubai, we have completed phase one for the largest aluminum site in the world, during which we installed our brand new DLN 2.6+ to drive down carbon emissions. We also have a waste-to-energy project with the municipality, which has shown great willingness to apply new technologies. Our gas turbine repair shop in Abu Dhabi has existed for years; it employs 100 people and serves neighboring countries as well as the UAE.

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. In the last year GE unveiled its FlexEfficiency concept, which can also be integrated into renewable energy plants. We have built two integrated solar combined cycle pilot plants, which can reach 70% efficiency, and it is only a matter of time before the technology is implemented in this region. We have also improved the efficiency of heavy fuel oil in our combined cycle gas turbines. If the UAE is to double its generation capacity by 2020, it needs our help, as

we continue to invest in new products and upgrade our existing equipment. GE spends \$6 billion on R&D every year.

There have been global trends toward flexibility and efficiency. How does your FlexEfficiency range compare to the similar products of your competitors?

Our FlexEfficiency 50 and 60 models have achieved record efficiencies. The key differentiator, however, is their flexibility: the ability to switch on and off, and ramp up quickly. We compete not only on the quality of our equipment, but also on our service support, personnel and local footprint. Without the quality of our equipment and services, GE would not have achieved such great success in the Middle East.

Your TS1000 coalescer is well suited to the desert environment here. Do you find there are unique challenges to the power sector in this region?

When you build a power plant, the ambient temperature and environment are key factors. You need units robust enough to survive under the local conditions, with the right filtration to deal with dusty weather, and nearby service facilities and people. Because summer is when energy demand is highest, we plan ahead of time to avoid outages occurring then. Being an oil-rich region, with diversity of fuel and special climatic requirements, the Middle East is a hub for innovations. Technologies developed by GE in the Middle East are fully transferable to the rest of the corporation.

Do you expect a further expansion of Abu Dhabi's nuclear program beyond the four units currently under planning and construction?

Global nuclear activity has slowed after what

happened at Fukushima. People are questioning whether the plants can ever be considered safe, and you can count the number of new ones being built on the fingers of one hand. It is possible the UAE's nuclear program will be expanded. They took a very bold decision to go ahead with it, and will evaluate the situation in a few years' time when the first production is underway. It is a very long process: there are about 15 years between announcing a nuclear plant and seeing it operate. If there are any more tenders, we will certainly bid again.

GE also possess market leading renewable technologies. How important is the sector within your power portfolio?

GE has been successful in wind. Enron Wind was worth \$350 million when we acquired it; now it is an \$8 billion business. This region does not have a great wind map, however. The Gulf has only occasional wind farm opportunities – there was one we showed interest in last year – and we don't expect them to play an important role in future. Dubai has set extremely bold renewable energy targets, and we are used to the emirate executing its promises, of course Abu Dhabi also. I believe solar power is the future of renewable energy here. A lot of big companies are leaving the sector, but GE still feels it has growth potential. Efficiency and costs are the two challenges, which we are on the way to overcoming. Our diversity of solutions includes thin-film PV and CSP. Mixing CSP with combined cycle high efficiency will represent a revolution. We are in dialogue with all the government stakeholders in solar power in the region. Although Mubadala is a major GE shareholder, we do not have any special privileges with its subsidiary Masdar; it is a very respectable customer of ours, and we are always seeking to improve our relationship. •



INTERVIEW WITH

Remi Coulon

CHIEF COMMERCIAL OFFICER
AREVA RENEWABLES

How important is renewable energy becoming for this region, and how important is the region becoming for the global industry?

Renewables are very strongly growing in the region: clearly, saving precious oil resources for export is a key driving issue. Saudi Arabia has calculated it may have to import oil in a few decades if it cannot change the current trends. Committed to renewables for now over 10 years AREVA acquired advanced technologies, such as offshore wind and concentrated solar power (CSP) to develop a diversified and complementary portfolio.

The group was among the first to enter the high-output offshore wind market with the Alpha Ventus park located in the North Sea, demonstrating the high performance and reliability of AREVA's offshore wind technology. To date, the group has over 600 MWe being installed, over 1,500 GW confirmed in its pipeline and much more under advanced negotiation, placing the company among the top three in the industry globally. AREVA is also the worldwide leader in the bioenergy sector, with more than 2,500 MW installed capacity or under construction and an expanded market position. We are also active in energy storage through hydrogen and fuel cell technologies, and have several key innovative projects being deployed and in use.

In solar energy, AREVA's Compact Linear Fresnel Reflector (CLFR) CSP technology was the first to deliver direct, superheated steam at the Kimberlina power station in Bakersfield, California. The group has 300 MWe of CSP capacity in operation and construction, of which a 2X125 MW project in India for Reliance Power to become Asia's largest solar power installation. Solar is the key; helping the industry benefit from the abundance of sun here is an important policy issue. The big question is which type of solar power to pursue.

Do you see space for experimentation in the leading solar models here?

There is room for experimentation in the different types of solar here. AREVA is only involved in CSP, still a relatively new industry; the technology was pioneered about 30 years ago but went into sleep mode until just recently. We see the room for improvement every day. With so many different types of CSP and all the developments taking place, it would be a big mistake for a country to pick one technology and stick to it for the next 20 years. Our own technology has been able, in just a few years, to dramatically increase the temperature of steam reached at the outlet, from 300 to 500 °C, thereby increasing its efficiency and economics. There is scope for R&D in adapting to the specific needs of a region, such as desalination in the Gulf. There is also potential here for the type of solar projects we are doing in the US and Australia, which directly use the steam produced by our solar field into the turbines of neighboring conventional power plants to reduce fossil fuel consumption. The economics of these booster/hybrid applications are very compelling.

Considering the slow uptake of projects and the recent influx of companies into the region, how competitive are you finding the market?

It is competitive, there is no doubt about it. The uptake of projects may be slow, but we take a long-term view; it takes time to build and implement an energy program the right way. AREVA has set up a local office in Riyadh, and is not discouraged by the pace of movement in the region. In the Middle East, business is gained through trust and long term commitment, although of course you also need good products and technologies, as well as project bankability. Backed by the weight of our shareholders and our strong and stable financial position, we are able to provide strong

corporate support. Our solar credentials have already been proven, with three projects worldwide deploying our technology, including the largest Asian CSP plant in India; and our technology is more suitable than our CSP competitors' for booster/hybrid and desalination applications.

The question is now how we, the CSP industry, face up to photovoltaics; which are, like the field of renewables in general, growing at an incredible rate. Many countries have separate programs for these two types of solar energies. The potential for localization is one important political advantage we hold with our CSP technology, and our clients clearly see also the benefits of CSP in providing much more storage and dispatchability than PV. When clouds come over PV, production stops instantly, while CSP has at least 20 minutes of thermal inertia, and we are bringing in a storage solution, which allows power production to shift for up to 10 non-sun hours. Our clients more and more also compare the grid impacts of PV and CSP in their assessments, and this is an area where we clearly have an edge. In any case, this Darwinian race between us drives down costs and is good news for the region.

The UAE's ambitious renewable energy targets mean a boom has to take place sooner or later. When do you envisage it happening?

What we see at the moment is an explosion of pre-project activity. It will take a few quarters to get the projects launched and financed but, believe me, business is already quietly and invisibly picking up. Although solar power is much less complex than nuclear, people still want to see through demonstration projects that things can be done, showing the feasibility of solar projects in the UAE. •

The Nuclear Age

Big investments and long-term planning

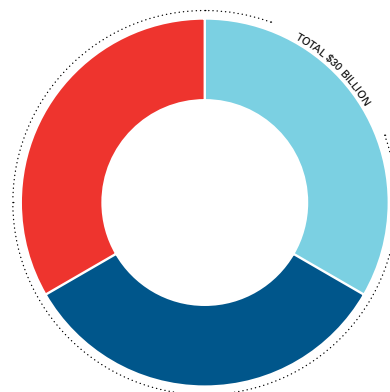
Countries by Nuclear Energy Production (2011)

Source: World Nuclear Association

RANK	TOTAL NUCLEAR PRODUCTION (TWh)	SHARE OF TOTAL ENERGY PRODUCTION (%)
1. USA	790.4	19.2
2. France	423.5	77.7
3. Russia	162.0	17.6
4. Japan	156.2	18.1
5. South Korea	147.8	34.6
6. Germany	102.3	17.8
7. Canada	88.3	15.3
8. Ukraine	84.9	47.2
9. China	82.6	1.8
10. UK	62.7	17.8
21. UAE (expected 2017)	15.0	13.6

Estimated Project Finance Sources

Source: Bloomberg



- Abu Dhabi \$10 billion
- Export Credit Agencies \$10 billion
- Bank Financing and Sovereign Debt \$10 billion

With all the worries about nuclear ambitions in Iran, it is encouraging to see atomic power being harnessed with altogether more peaceful intentions on the other side of the Persian Gulf. 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.

The plans for nuclear power in the United Arab Emirates are relatively recent: Abu Dhabi established the Emirates Nuclear Energy Cooperation (ENEC) in December 2009 to oversee the nuclear sector. Current plans are to establish 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, with a \$20 million bid. Construction started on the first reactor (set to come into operation in 2017) in July 2012, and all four are scheduled to be completed by 2020. Combined, they could make up as much as 25% of the emirates electricity capacity, representing a total of 5.6 GWe, providing the primary baseload of power demand.

Even in these early stages, this development is already being viewed as a success in many regards. "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.

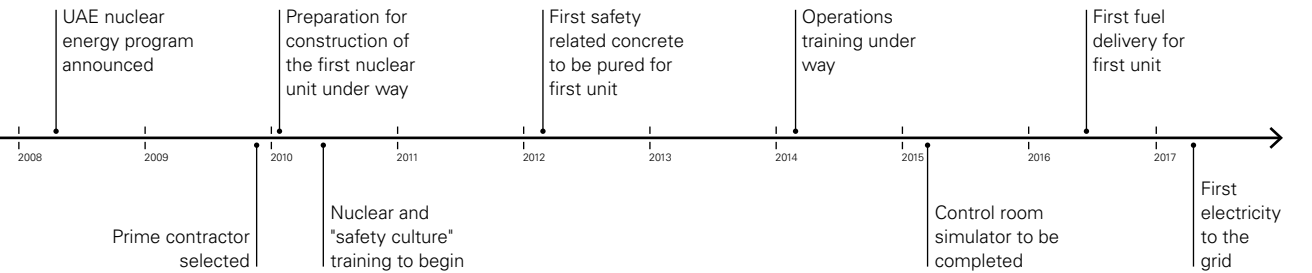
The pride of ENEC is not misplaced. The design changes made to the UAE's four

proposed nuclear power plants in the wake of the 2011 Fukushima disaster in Japan were praised recently by Dr. William Travers, Director General of the Federal Authority for Nuclear Regulation (FANR). The UAE is also in close consultation with the International Nuclear Energy Agency. Nuclear energy is important for the sector. A 2008 study by the UAE projected electricity demand shooting up from 15.5 GWe to 40 GWe by 2020: natural gas supplies are sufficient to meet just 50% of this, renewables are estimated to be able to account for just 6% to 7%, and imported coal was dismissed as an option due to environmental and energy security concerns. Yet quite apart from its necessity, this new field represents a significant opportunity for companies. ENEC was initially funded with \$100 million and no doubt there will be a lot of contracts on offer for private firms.

"We have already worked for ENEC, although our involvement in the nuclear program is not so extensive yet... The nuclear reactors do, however, need a lot of instrumentation, which we can supply in partnership with Endress + Hauser in Korea. Certainly for any work going to local providers, Descon is right at the forefront, this should be very applicable to the renewable sector," explains Basu Sil, CEO of Descon, one of the largest local instrumentation and automation companies in the region.

UAE Nuclear Energy Timeline

Source: ENEC



Planned UAE nuclear power reactors

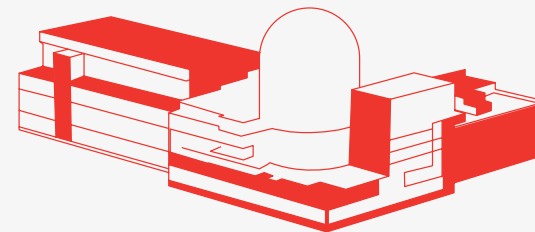
Source: World Nuclear Association

	TYPE	MWE GROSS	CONSTRUCTION START	START UP
Barakah 1	APR-1400	1400	7/12	5/2017
Barakah 2	APR-1400	1400	mid	2018
Barakah 3	APR-1400	1400	2013	2019
Barakah 4	APR-1400	1400		2020
TOTAL		5600		



Design Features of the APR-1400 Nuclear Reactor

Source: Korea Hydro & Nuclear Power Co.



REACTOR	SAFETY INJECTION SYSTEM (SIS)
- Thermal Power : 4,000MWth	- Independent 4-Train SIS
- Hot Leg Temperature : 615°F	- Direct Vessel Injection
- Thermal Margin : >10%	- Fluidic Device in SIT
PRESSURIZER	STEAM GENERATOR
- Total Volume : 68m ³	- Tube Material : Alloy 690
- POSRV for safe depressurization	- Plugging Margin : 10%

Comparison to other Reactors

Source: World Nuclear Association

	APR1400	AP1000	EPR	ABWR
Developer	KHNP	WH/Mitsubishi	Framatome ANP	Hitachi/Toshiba/GE
Power Capacity (MWe)	1,400	1,100	1,600~1,700	1,300
Design Life (Year)	60	60	60	60
Construction Period (Months)	48 (APR Nth)	36	57	48
Operator Response Time (Min.)	30	-	30	-
Refueling Time (Months)	18	18~24	18	18~24
Emergency Core Cooling System	DVI	DVI	CLI	3Train SI
Core Damage Frequency	2.46x10 ⁻⁷ /RY	2.5x10 ⁻⁷	-	1.6x10 ⁻⁷
Earthquake-Resistant (g)	0.3	0.3	0.25	0.3
Tube Material	Alloy 690	Alloy 690	Alloy 690	-



INTERVIEW WITH

Mohammed Al Hammadi

CEO
EMIRATES NUCLEAR ENERGY CORPORATION

What were the key factors influencing the decision to pursue a nuclear program in the Abu Dhabi?

The decision to launch a nuclear program was based on an evaluation in 2007 of the UAE's energy needs. Although the UAE is a fossil fuel-rich country, unfortunately the quantities of gas cannot supply electricity demands in full. Renewables and nuclear power were identified as good energy sources to make up the shortfall; nuclear energy is more economical than burning diesel, and it produces almost no CO2 emissions. In 2008 the government published its nuclear energy policy, committing itself to the highest standards of safety and security. This was translated the following year into law, leading to the establishment of an independent nuclear energy regulator and, of course, the Emirates Nuclear Energy Corporation. Since then we have awarded contracts for construction of what is one of the biggest energy projects in the Middle East, and we have received construction and environmental licenses for our power plants.

There must have been a lot of interest in the project's tender. Why did you choose KEPCO as the primary contractor?

ENEC scanned the market and short-listed three companies that were qualified to run the project. We had a comprehensive evaluation team of 120 people carefully reviewing these companies for their records in safety, environmental stewardship, human capacity development, security and for their ability to deliver. KEPCO matched up to our criteria, and we are delighted with the project's progress so far. Today, there are 6,500 people working on-site.

What training and educational schemes has ENEC put in place?

ENEC has a very comprehensive program in place. It was clear in 2008 that staffing would be a key challenge, so we introduced various streams for human resource development. More than 170 UAE nationals went to study relevant degrees abroad. With Khalifa University, we established a nuclear bachelor degree program; and we have more than 60 students taking conversion courses from electrical to nuclear engineering at Abu Dhabi Polytechnic. We recruited talent from the nuclear energy sector, as well as utilities and oil and gas, and have received support from Korea and Westinghouse to develop senior reactor operators. Today, more than 65% of our manpower is Emirati, but we still have a good international mix of more than 30 nationalities. It is a very healthy work environment.

Because of its cleanness and reliability, there is also the potential to export nuclear power. Are any agreements in place?

Our nuclear program only took into consideration domestic requirements, which can still only be met with a combination of other developments. The Abu Dhabi Water and Electricity Company (ADWEC) will be ENEC's single buyer, any further agreements will be through them.

How do you see the development of the industry around nuclear? Will there be opportunities for local companies?

In 2008 we looked at all the infrastructure surrounding the nuclear industry. Some things needed to be upgraded, and others did not exist. New entities, besides ENEC, were created. Infrastructure, maintenance systems and material supply would all have to be provided by the private sector. An industrial road-map is being developed to make our nuclear program sustainable. It helps that the UAE has a very robust oil and gas platform to build on; various companies have be-

come qualified nuclear suppliers by upgrading their quality standards to ASME Nuclear Component Certification programs.

The pros and cons of nuclear energy are hotly debated around the world. Where does public opinion stand here, and how is ENEC battling against negative perceptions?

The nuclear industry has provided a clean, safe and secure source of energy for decades now. A fingertip-size of uranium oxide produces the equivalent energy of a ton of coal; the fuel is very condensed in size, and can be stored safely and securely for 20 years inside the spent fuel pool. Following this, nuclear energy operators have the option to store spent fuel in drycask storage or in geological repositories. Security of supply is much more reliable for nuclear plants than, for example, coal. Plants around the world have been shown to be safe. ENEC has chosen a very advanced generation three reactor and the safety systems among the most robust in the world.

Independent surveys have shown higher level of public support for nuclear energy in the UAE as in the US and other mature nations. The engagement of the public and education is critical, because the industry is not well understood – mainly because of its size in relation to oil and gas. More than 4,500 individuals have attended our regular public forums: some are concerned parents, but others are just there to gain a greater understanding. Those who do arrive with a negative view of nuclear energy often leave with their perceptions completely reversed. Those who do arrive with a negative view of nuclear energy often leave with their perceptions completely reversed. Nuclear technology is set to advance in the coming decades, further enhancing its advantages: safety, efficiency, reliability, cost and sustainability. •

INTERVIEW WITH

Roy Dabbous

REGIONAL MANAGER – MENA
HATCH

In the power sector, how important is this region for Hatch's global corporation?

This region's power industry is large and continues to grow impressively. Even supporting our key local and international clients on a portion of the work would be significant amount when compared to other energy markets, as such this is a strong focus area for Hatch. It takes time to establish the relationships and reputation which are all-important here. Initially, we had been supporting our international clients (developers) in the market. Based on this success Hatch is now focusing our efforts on regional utilities as well.

What power projects are you currently working on in the UAE?

Hatch has worked for many of the developers in the UAE, such as Sumitomo Corporation; we also work with a lot of the lenders. For example, we have been the lender's technical advisor for the recent project financing of all the Power Plants associated with aluminium smelters totaling some 3,500 MW capacity. Our energy division locally is growing and supported by international staff from our centers of excellence around the world.

What differences have you seen between Dubai, Abu Dhabi and the northern Emirates in demand for your services?

Abu Dhabi's model appears to be the envy of the region. It brought in foreign support the right way from the start, and is always looking at unique ways of doing things. DEWA is an established utility with an excellent and up and coming PPP program. SEWA and FEWA and the northern Emirates are also trending well for the future, but some of their additional power requirements may well be coming from Abu Dhabi.

Gas will remain the primary source of electric-

ity for years to come. What trends do you see over the next decade?

Co-generation of gas with desalination plants will certainly continue: it is the most environmentally friendly way of meeting power requirements. The UAE's renewables program will take time to have an impact, but they are taking all the right steps and have extraordinary vision to push it through. Even during the financial downturn, it was the correct decision to make those capital investments. 2017 is being given as the year when, to be comfortable, the UAE needs nuclear power; beyond then, its abundant supply of gas at max production maybe tight based on current power demand growth projections. 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, but that is one of Hatch's core strengths, of course.

Do you see good opportunities for Hatch from these developments, and how competitive is the market for your services?

One of our biggest projects in the UAE came as a result of these sour gas projects. It has allowed us to add permanent staff to the office. Being an employee owned company, we have a different risk-profile from other companies and prefer to grow based on projects in hand. Competition is very strong in our market, but Hatch was able to differentiate itself through combining its niche capabilities in sulfur and material handling. Overall we have higher rate of PhDs per capita on staff than most of our peers, as such we prefer technology projects and First of Kind Projects. For example, we have an excellent gasification group which is strong in such technologies as IGCC; and we were at the cutting-edge of the wind industry during its infancy.

Do you anticipate the nuclear program being expanded beyond 2021, and what opportuni-

ties does the sector provide for Hatch?

There has been discussion about expanding the nuclear program further, but I suspect they would like to first see how smoothly the early stages go. The UAE has again shown tremendous vision in nuclear: it is always looking 10 years ahead. The country might well have enough gas to last until 2030 or 2050, but it doesn't want to take the risk. Hatch is eager to get more involved in the sector; close to 20% of our global business comes in operational services, which extend to nuclear power. Nuclear plants are not like traditional oil and gas facilities – even changing out valves are very complicated tasks – so you need an experienced engineering team to support your operations team.

This region is ideally suited for solar power. Is the current framework adequate in pushing it forward, and how much interest does Hatch have in the industry?

The solar framework is moving in the right direction. It is not clear when the appropriate feed-in tariffs will come in, but the push is there from the government. Establishing Masdar was a fantastic step: it is a world-leading organization which has started something of a domino effect across the region. Hatch is growing its solar business globally, and the UAE's industry will increasingly be of interest to us.

How would we find this office if we returned in five years' time?

I would like this office will have blossomed to a few hundred people in five years' time, strong across all the sectors Hatch covers. Hatch's model has always been to follow its clients; the UAE now has some very good companies which are going global and we are already assisting them here and in other parts of the world, a trend we hope to continue. •

Harnessing the Sun

Solar power in a desert environment

The UAE is a hot country. Rain, or overcast weather of any kind, is extremely infrequent, at least in the more populated coastal areas. On this extremely unscientific basis alone, the country should have significant potential for solar power.

Luckily, more scientific estimates confirm the initial perception. Solar power is a key element in the UAE's forthcoming era of diversification and its highly anticipated adoption of renewable technologies.

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 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, 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, con-

structed 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" suggests 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 chal-

lenges 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 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. •





INTERVIEW WITH Saeed Ghubash

DIRECTOR
ENPARK

Could you provide an overview of Enpark and the services it offers here?

Enpark is a free zone business park dedicated to facilitating and fostering the growth of alternative energy and environmental industries. We focus on the energy, renewable energy, green building, recycling and solid waste management sectors. Along with our sister business park DuBiotech, we belong to the science cluster of a family of free zones under the umbrella of TECOM Business Parks, which covers other sectors such as ICT, education and media.

ENPARK provides resources for environmental and energy companies to establish themselves in the relatively untapped market of Dubai, giving businesses easy access to the Middle East and North Africa. These include: first-class infrastructure in conjunction with DuBiotech, free-zone benefits, comprehensive support system and a number of value added services such as programmes, partnerships and amenities to facilitate synergies that favour innovation, growth and development. It is an ideal one-stop platform to coordinate large projects and deploy new green technologies across the region.

What differentiates Enpark from Silicon Oasis and Masdar Free Zone in the minds of companies entering the UAE?

The idea behind TECOM Business Parks' industry-specific free zones is to foster the growth of vibrant industry hubs and business to drive the development of knowledge-based economies in line with the UAE Economic Vision 2021.

Besides providing a full range of sustainably designed real estate products, and a legal platform to supply their technologies and services to the GCC market, Enpark also offers its business partners networking opportunities with other businesses and relevant authorities.

We always promote collaborations with our business partners; for instance, we have recently worked with a waste management company on a reverse vending machine incentivizing the recycling of plastic bottles and cans, unique to this part of the world. We understand we are not experts in waste management ourselves, but there are still benefits to the company partnering with us.

Dubai has consumed energy inefficiently over the years. To what extent is there the political will to focus on efficient usage?

It is clear that efficient consumption of energy is becoming more important to the UAE's federal and emirate governments. This is apparent from investments in renewable projects and the recent release of the Ministry of Energy and Environment's federal strategy in collaboration with the GGGI. The government has a roadmap toward the UAE becoming a greener economy, touching on a whole spectrum of issues including renewable energy, demand management, waste management and water consumption. Shams One, Shams Two, the Sheikh Mohammed Solar Park and Abu Dhabi's nuclear program are all proof of how seriously the UAE is taking its environmental strategy.

But we have been hearing the same message for a long time, and yet there are few projects on the ground. Why have we been waiting for so long?

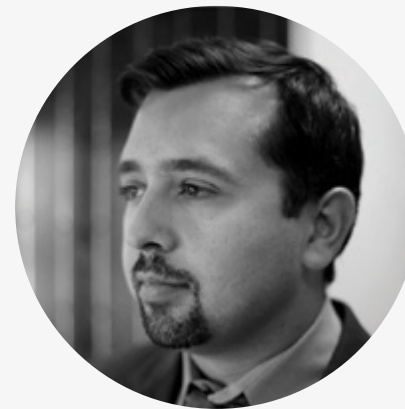
I disagree that there are few projects on the ground: we have seen some real developments. For example, the 13 MW first phase of the Sheikh Mohammed Solar Park has already been awarded to a multinational; by the end of 2013 this project will start to reap benefits. It will take time to see all the goals of the renewable program being met. These projects are very capital intensive and require large

land packages, but we are certainly moving in the right direction. International companies understand the abundance of sunlight in this region, but the development of the solar industry also requires the government to design good regulations and provide the right financing tools. We know it is working on feed-in tariffs, which I believe would act as a trigger, enabling viable investments from businesses and consumers. Solar water heaters are another major topic of the moment.

All in all, the future is very promising and we foresee significant growth, not only in the solar industry, but in the entire renewable energy sector.

Are solar PV and CSP companies entering Dubai a major source of potential business for Enpark?

Enpark is strongly targeting solar companies. We participated in the Solar Middle East 2013, which for the first time is being held within Dubai's long-running electricity show. This gives us further confidence the sector is growing; and the number, and quality, of solar companies exhibiting at the World Future Energy Summit is an indicator of the industry's potential in this part of the world. One way the industry can demonstrate its environmental credentials is through local manufacturing; this is not yet featured at Enpark, but given the recent regulatory changes in the market it is only a matter of time before companies see the benefits. I have no doubt the UAE will come to act as a scientific research and manufacturing hub for solar power in the whole region. •



INTERVIEW WITH Vahid Fotuhi

PRESIDENT
THE EMIRATES SOLAR INDUSTRY ASSOCIATION

Could you give us an overview of the Emirates Solar Industry Association (ESIA)?

ESIA is a non-profit organization focused on growing the solar community in the UAE and the broader Middle East region. We do this by bringing together three key groups in the solar industry: the private sector, academia and the public sector. We achieve this through the various events and launches that we organize throughout the year, including networking opportunities, breakfast briefings, surveys, and gala events such as the ESIA Solar Awards.

Your report earlier this year was fairly positive, whereas your upcoming report explores the challenges the solar industry will face: have there been significant changes in the past 12 months?

The overall outlook looks very positive. What this shows is that the local industry has started to dig deeper and look at all the various steps involved at incorporating solar power into the region's energy mix. Through this exercise some challenges were uncovered. This is to be expected whenever you try to change things. But rather than walking away, we see policy makers and the private sector coming together to find tangible solutions to overcome these challenges. This is a very exciting and promising development. It bodes well for the long-term prospects of solar power in the UAE and the broader Middle East region.

The lack of a legal framework is a key challenge, have you seen signs on development in this regard?

Yes. When we published our earlier report we identified the lack of a legal framework as there was no framework for solar power in Dubai. But gradually this is changing. In Abu Dhabi and in Dubai we see the utility

companies putting in place legal frameworks that will empower the residents of the UAE to install solar systems on their roof and create their own electricity, thus reducing the generation burden on the utility company while also reducing the country's carbon footprint. Everyone wins!

What is your perspective on the differing level of political backing for solar power in Dubai and Abu Dhabi?

I am pleased with both Dubai and Abu Dhabi's initiatives to promote solar power in the past few years. They have shown determination and willingness to put into place the policy framework and the supporting infrastructure needed to sustain a healthy solar industry. Dubai in particular has been very impressive with the launch of the Sheikh Mohammed Bin Rashid Al Maktoum Solar Park which will eventually house some 1,000 MW of solar energy. Already, they have tendered and awarded the first 13 MW slice of this initiative within the first year of its inception. By regional standards, this is fantastic.

Siemens recently announcement that they are to step out of the solar energy market, what are your views on this move by a major player?

The market continues to evolve, with new companies entering the market while some others exit. This shows you that the market is very dynamic. Perhaps for Siemens it was a matter of allocating its focus and resources to better performing business units. If I was the CEO of Siemens I would likely do the same thing. But despite their decision, we see the industry continue to grow globally as the cost of solar energy continues to drop.

Supply of low cost natural gas from Qatar would suggest a sustained low natural gas

price in the UAE, how does this impact the viability of renewable energy?

The most successful energy strategy is a diversified energy strategy. It would be competitive to tap into solar resources for domestic consumption and to use fossil fuels for exports. The difference between the solar and the gas revolutions is that solar energy is sustainable. To produce gas you need substantial amounts of water and energy, which makes it not very sustainable, particularly in this part of the world where countries are covered by over 90% desert with very little water.

Your report earlier this year suggests a 5% cost improvement per year for solar energy technology, do you still believe this can be sustained?

Easily. We have seen a 50% cost decrease in the past two years. The cost structure can decrease as long as there is more innovation beyond the solar panel and into the balancing system; the panel, the mounting structure, the invertors, combiner boxes and the cabling. I see prices continue to fall for a few more years, which is exciting news for the utility companies and the end-users.

Summing up, where do you see solar energy for the UAE in the next five years?

There will be two key markets in the UAE. Abu Dhabi is targeting 1500 MW of solar energy by 2020 and Dubai is aiming for at least 1000 MW by 2030. We are confident that both of them can achieve the targets they have set. In the case of Dubai, they even have the potential of exceeding it. So this is very exciting news for solar companies who are looking to establish a hub in the Middle East. Not only does the UAE offer fantastic living standards for expatriates, it also holds potential for lucrative solar contracts in the years to come. Such a combination is hard to beat. •

INTERVIEW WITH

**Christopher Burghardt
& Matt Merfert**

VP BUSINESS DEVELOPMENT EAME
& EPC COUNTRY MANAGER
FIRST SOLAR INC.



Could you give us an overview of First Solar's operations in the UAE?

CB: We have a Middle East commercial team of 12 people, which is based in the UAE and in Saudi Arabia. I am based in Dubai, covering Europe, the Middle East and Africa. Our office(s) will grow alongside growth in the regional markets. From a power plant perspective, we have the Masdar plant as well as our DEWA project.

MM: We are using the DEWA project as our showcase project, to act as a launching pad for First Solar in the region. The DEWA project will allow us to make key hires, engage suppliers and local engineering firms, and establish the connections required for a more permanent presence. We will have about 20 First Solar employees on the project, and we have built up a project management structure, partnered with a local engineering firm and built up our compliance framework. I expect us to break ground in early 2013.

How important is the Middle East region for First Solar on a global level?

CB: We believe the Middle East has the potential to be one of the most important solar markets in the world. We expect significant company growth to come from the Middle East over the next five years. Projects are coming up in Kuwait, possibly in Oman or Qatar, and in large North African markets such as Egypt and Morocco.

Could you elaborate on which technologies you are providing in the Mohammad Bin Rashid Al Maktoum Solar Park?

MM: The Mohammad Bin Rashid Al Maktoum Solar Park project involves a contract for both turnkey EPC (engineering, procurement and construction) services and supply of our own proprietary thin-film PV modules.

What type of involvement did First Solar have on the Masdar project?

MM: The Masdar city plant is a 10 megawatt project installed in 2009, and it includes five megawatt of First Solar modules. Enviromena was the general contractor on this project.

Looking towards the future, will First Solar be more heavily focused on providing EPC services or PV modules?

CB: First Solar business is focused on providing integrated PV power plants, so EPC services is an important part of our business, but it is also a way for First Solar to sell its modules. We are the most experienced company in the world at designing and building utility-scale solar power plants, so especially in a new and quickly growing market like the Middle East we believe that expertise can help the government and our customers meet their objectives. That said, if we can provide greater value by partnering with local contractors, we will certainly do so, and we evaluate this on a case-by-case basis. We have a strategically opportunistic business model and are focused on supporting a sustainable solar market in each region. When supplying a public good like power you want to ensure that the citizens receive the economic and social benefits. For this reason, we work with governments and local companies to provide knowledge transfers. The market is very young here, and besides just paving the way for the solar market, we are trying impact the market through our technology and expertise.

Could you elaborate on the advantages of First Solar's thin film PV technology?

MM: First Solar modules can be differentiated by the basic semi-conductor physics and raw materials used in production; we use a

thin-film semi-conductor, as opposed to 90 per cent of the market which uses typical crystalline silicon. 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. First Solar modules have a proven performance advantage over conventional solar modules, due to a superior temperature coefficient. This shows up in our energy yield, and we therefore enjoy a strong advantage in this climate. Our modules are calibrated at 25 degrees Celsius, but in these environments the modules will typically spend the majority of their time above this.

CB: 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. First Solar has close to two thirds of the market share of above 100MW plants, most of which were built in hot environments such as the south-western US. Although the production of thin film is less expensive and more automated, it is also much more complex, so it is difficult for new companies to penetrate the market. Today there are only two large thin film companies, Solar Frontier and First Solar, although GE is also potentially entering. Aside from these three companies it is mostly small players entering this area of technology. And since we have the most experience building and operating large-scale solar power plants, we have a substantial amount of real-world data that enables us to optimize the design of our power plants.

Could you elaborate on the 'green' advantages of the thin film technology?

CB: Less electricity is used to produce the thin film modules. Our modules are industry leading in terms of Energy Payback Time—how long a module needs to be in

the field before it has produced the energy that was used to manufacture it. Because our process is highly automated and continuous, our modules take 2.5 hours to produce from the time a sheet of glass is fed into our production lines until a completed module comes out the other end. A crystalline silicon module takes about a day and involves many separate operations, often in different factories. From a CO2 perspective that makes a big difference. Our raw material use is also minimal: we use by-products from mining as semi-conductor materials, and glass which is fully recyclable. About 90% of our modules and 95% of the semiconductor material is recycled and reused. From an environmental perspective it is almost a closed loop, and it is extremely efficient. The lifespan of our modules are also extremely long. So on a life-cycle basis, we believe we our technology has the best environmental attributes of any solar technology.

Where would you like to see First Solar UAE five years from now?

MM: From the EPC perspective, our goal is to translate our leadership and experience from the U.S. to the Middle East. Our mission is to enable a world powered by solar electricity. The opportunity cost of oil and gas is vast, and First Solar can help oil-poor countries either offset very expensive imports in energy or solve the energy security problem. My goal for the next five years is to see more widespread solar adoption, and I believe First Solar has the technology and experience to facilitate that.

CB: In the future, we hope that Dubai and Abu Dhabi will execute their solar plans, and that we will earn a large share of the market by supporting them. We also hope that our business can help create economic and social value for the UAE. •



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INTERVIEW WITH

Dr. Hamid Kayal

CEO
CSEM-UAE**Could you provide a brief introduction to CSEM in the UAE?**

This company, in the UAE, is shared between RAKIA and CSEM in Switzerland. In our home country, we were originally founded and funded by the government of our local area. Our shares were left open to public companies, about 55 of which own part of CSEM in Switzerland, including Logitech, ABB, Siemens and Swatch: the watch industry makes up 40% of our ownership today, the Swiss government 30% and the local governments 30%. CSEM's laboratories assure its competing shareholders of full confidentiality. The idea was for industry to be able to use our facilities and specialized engineers for certain periods of time without needing to make investments of its own. For trial projects, the government can pay 50% of the costs and companies have the option to buy back all the IP rights at a later date. The emirate of Ras al-Khaimah (RAK) knew the story of our success, and in 2004 it decided to build an industrial facility to attract industry by providing it with R&D assistance. I think it was too early: CSEM arrived to support an industry not yet in existence. We had to conduct projects for outside companies, like South Americans studying high-precision telescopes, which could have been better done in Switzerland. From 2008 we had the idea to concentrate on areas of regional strength and need. In the context of a region with rapidly rising electricity demand, and gas, which could be more profitably sold abroad, we decided to build infrastructure for clean-tech and renewable energy. We have concluded it is possible to fulfill the growth requirements of local industry in a sustainable and evolving way, while maintaining our original Swiss structure. There has been extensive debate on renewable energy here, which we see to be of in-

terest not only within the region but also for the energy sector worldwide; in Switzerland, for example, people want to move beyond nuclear energy. After eight or nine months, it became clear that renewables in this region basically meant solar. Our research over the last few years shows the need to focus on the harsh weather found locally: humid, dry and dusty. 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. If we can develop economically viable products in this region, they are certain to sell in the other countries as well. Given the main uses of energy here, it may be more economical to transfer solar power directly to cooling or desalination than to electricity; our platform is designed to integrate existing technologies and products to provide workable solutions for the region, whether for generation or the reduction of consumption. Our objective is not to compete against other institutions in the country; we have attempted to learn from Masdar and Dubai, and form a mutually beneficial partnership with the government of RAK. As in Switzerland, we aim to recoup our investment in incubated companies by selling our shares once they are successful. CSEM-uae is a not-for-profit organization and, while supported by the RAK government, we are tasked with producing enough income to ensure our own growth; we therefore work on projects with economic possibilities, or which can enhance our reputation and, thereby, our recruitment power.

Tell us about your specific innovations. The solar island was one that hit the headlines.

The solar island was our first project. Our location, next to a built-up coastline, made it easy to construct. The aim was to find,

by first building a prototype, a low-cost, high-performance, low power-consumption and high-precision technology. CSP and PV may be well-established, but they still require huge new investments. RAK has less money than Masdar, which is also actively collaborating with multinationals, so the solar island seemed a good solution for medium-to-low level energy supply. It can serve villages or districts, and does not need to be built out in the desert. It is not ugly and has been shown not to cause environmental damage to the sea. From the solar island, we can produce electrical energy as well as heat for coal production and desalination. It consumes very low quantities of power; we are turning 300 tons of material with the equivalent power of two hairdryers. We are not aiming for the highest of yields; our intention is not to compete with the best technology, but to bring an implementable solution. We are using cheap mirrors at high precision to get the best yield-cost combination.

Which companies have you partnered with for the solar island?

The first partner for the solar island was a Swiss start-up: it originally owned the IP but gave the rights in GCC to CSEM-uae in 2010. Now we are working with three world-leading universities and opening up the concept to PhD and master's students. Industry is also collaborating by testing materials in the project, but CSEM-uae worked on the design alone. Where we subcontract work, we try to give it to local companies who can learn from it; less than 5% is so specialized it needs to go to the supplier. In the meantime, the government is using us as consultants for companies proposing new ideas; we have an international field of experts to draw upon. •

Race towards the Sun in the Sunbelt

Dr. Michael Krämer – Senior Associate
Taylor Wessing (Middle East) LLC

The Middle East, and particularly the Gulf region, is rich in oil. It is equally rich in solar irradiation, however, and while extracting oil from the ground has now been done for various decades, making use of the Gulf's renewable fortunes has yet to really begin.

The incentive to generate electricity from solar resources varies from country to country. Saudi Arabia, for example, currently consumes about one third of its annual oil production to cover its domestic demand for electricity. The generated electricity is then provided to the Saudi population at a fraction of its generation cost. Needless to say that one third of Saudi Arabia's annual oil output equates to dollar amounts that many countries could comfortably live with for several years. Hence, replacing oil fuelled energy generation with such that is solar powered makes a lot of financial sense.

The State of Qatar is a different story altogether. As one of the planet's biggest exporters of natural gas, Qatar is able to generate electricity at much lower cost. Of course, Qatar could export those natural gas resources it currently consumes for domestic consumption. Even then, however, generating energy by burning natural gas is cheaper than using oil for the same purpose. Hence, the incentive of generating solar electricity which comes at a higher cost is rather limited.

In the United Arab Emirates (UAE), virtually all electricity is generated by gas power plants which are fuelled by natural gas supplied by Qatar at far-below market rates. The situation is thus quite similar to that in Qatar, apart from the fact that the UAE are almost fully dependent on foreign gas supplies to meet domestic electricity demand.

By now, all countries of the Gulf Cooperation Council, namely Bahrain, Oman, Kuwait, Qatar, UAE and Saudi Arabia have committed to including renewables in their overall energy

mix. In addition, most GCC member countries have committed to more or less ambitious renewable energy targets.

At present, both Saudi Arabia and the UAE would appear to be closest to actually implementing a solar strategy. The UAE have taken the lead, having connected Shams 1 (a 100 MW CSP plant in Abu Dhabi) and the Masdar City 10 MW PV plant to the grid. Another 100 MW PV plant in Abu Dhabi (Noor 1) and an initial 13 MW PV plant in Dubai (first phase of the 1 GW Mohamed Bin Rashid Al Maktoum Solar Park) are in an advanced planning phase. Saudi Arabia, on the other hand, has announced concrete plans on building a total of 41 GW of solar capacity by 2030.

Who will win the race? In the long run, Saudi Arabia is most likely to be the most important solar market in the Gulf region. It has the need to move away from burning oil as the hand which feeds it. It has also the biggest population in the Gulf and the financial means to invest in solar technologies.

Due to its size and that of its population, Saudi Arabia usually cannot act as quickly as its smaller sized neighbors. The UAE, particularly Dubai, have frequently made use of this advantage and have positioned themselves as gateway to the Gulf and wider region. This could happen again, this time by the UAE implementing an ambitious policy for the development of a UAE solar market. A step into the right direction is that both Abu Dhabi and Dubai consider incentivizing private investment into renewable energy generation. Other markets have demonstrated that a multitude of comparatively small, rooftop solar installations usually make up the bulk of all installed solar capacity. Hence, encouraging home owners and small and medium sized enterprises to install solar systems on the roofs of their homes, warehouses or production facilities, be it by paying feed-in tariffs or oth-

erwise, is likely to create a healthy demand for solar products. This, in turn, is likely to result in the establishment of a local solar market, because supply usually follows demand.

There are lessons to be learnt from other markets. One of the most important lessons to be learnt is that solar investments require stability. A reliable policy without sudden, unforeseen changes is key to enable banks to develop low risk (and thus, low interest) financing solutions for solar investments. It also creates long-term demand for solar products, thus making it worthwhile for producers and suppliers of such products to set up shop where the market is. In order to be reliable, the incentive scheme cannot be too ambitious. Overly generous incentives that cannot be sustained in the long run inevitably create boom and bust cycles as has been witnessed in Spain. This must be avoided at all cost.

What does the future bring? My guess is that the UAE will "win" the race and establish themselves as the first market in the Gulf with a working solar market. In the mid-term perspective, however, it will not be possible to ignore Saudi Arabia with its massive projected demand. •

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About the Author: Dr. Michael Krämer is a senior associate at Taylor Wessing (Middle East) LLC who has been practicing in Dubai since 2005. He advises clients in relation to all corporate and commercial law matters and has a particular interest in environment related topics. He has published numerous articles and is a frequent speaker at conferences on legal matters related to renewable energy. He can be contacted on m.kraemer@taylorwessing.com.



INTERVIEW WITH Yousif Al Ali

GENERAL MANAGER
SHAMS POWER COMPANY

Could you provide us with an overview of Shams Power Company?

Shams Power Company is a joint venture established solely in order to run the Shams 1 project, a hybrid concentrated solar power (CSP) plant that generates power from gas and solar; it is a similar model to many plants in Spain. On Shams 1 we followed the IWPP model, which includes tendering and then creating a consortium. Our consortium includes Masdar (60%), Total (20%) and Abengoa Solar (20%); we are able to tap into the breadth of knowledge that comes from these highly experienced companies.

Construction on Shams 1 has now been completed, and we will start generating electricity in early 2013. We almost finished recruiting the team that will run the plant, and we will soon start training new engineers.

How significant is this plant for the Middle East and for the world?

Shams 1 will be the largest power plant in the world for a few months, and then it will remain the largest solar thermal power plant in the Middle East. When considering the significance of this plant, one must consider the challenges of constructing and developing the plant in a desert: the conditions initially came as a shock to the contractors and we underwent an enormous learning curve. Learning opportunities included the potential impacts of dust; how to build foundations; cleaning techniques, etc. Learning also took place during the construction phase, including on what could and could not be sourced locally. The learning that took place on Shams 1 will certainly help new companies in the future in this region, and we have been very open about exchanging information.

Do you believe Shams 1 will help attract solar investment to the region?

The success of Shams 1 will increase competition and attract more bidders in the future. When the tender took place for this project in 2008, only two bidders, or consortiums qualified. Shams 1 was a very risky project, both due to its size and as the first plant of its type in the region. However, the project has proven to be a great success, and we are now at the stage where solar is a very competitive technology. The industry has changed significantly since 2008.

How do you compare CSP and PV technologies? Which will be the obvious choice for this region?

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, dispatchable source of energy, and thus they will initially need to go for a mix. I would put the threshold at 5%.

How much will Shams 1 help support the growing R&D sector?

A lot of learning took place on Shams 1, from the development to the construction stages. We have many experts and students conducting research on the power plant, working on improving design and efficiency. By investing on the R&D side we will help improving the efficiency of the plant.

The lifespan of the PV plants in the region is

about 25 years. How does this compare with CSP?

The lifespan of both PV and CSP plants is around 25 years. This is the assumption made in the financial models, but often these plants last longer. For PV, the modules have a guarantee of 25 years, but often they last for many more years.

What should be the role of the government in encouraging renewable energy?

In Abu Dhabi, the model has been project-based, which can have its challenges. The feed-in tariff model, which has been used in Europe, presents more incentives for the companies, as it provides more guarantees. In Abu Dhabi, however, the target is only around 1.5 GW, and with this target it may not be necessary to go for feed-in tariffs. A project-by-project model may continue to work and may allow the government to have greater control. However, in other countries with higher targets a feed-in tariff may present greater incentives.

Do you have a final message for our readers?

We built a renewable energy project because it made economic sense, and this has surprised many investors, since the UAE is so heavily oil-dependent. The demand for electricity will double over the medium-term, and conventional sources will no longer be enough. My message is that renewable energy makes economic sense. •

Clean Coal

Polishing the dirty carbon



Considering that the UAE has generally dismissed the option of importing coal to feed their growing demand for electricity, due to environmental and energy security concerns, it initially appears surprising that the construction of a clean coal plant is going ahead. The UAE has no significant coal reserves and, keeping with their environmental consciousness, is a signatory to the Kyoto protocol on CO₂ emission reduction.

This plant is being built in the emirate of Ras al-Khaimah, by Utico in partnership with Shanghai Electric. The 270 MW plant is set to be completed in 2015 and, although yet to be confirmed, coal imports are likely to come from Indonesia.

Looking closer at the project, however, and it soon becomes apparent that it fits very well into the UAE's energy plans. Firstly, it is yet another strand in the policy of diver-

sification that they are so enthusiastically pursuing. Secondly, and more importantly, it offers another chance for the UAE to be at the forefront of energy technology, while still maintaining their green credentials.

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. •

INTERVIEW WITH

Richard Menezes

MANAGING DIRECTOR
UTICO

Could you provide an overview of Utico and its operations in the UAE?

Utico is in its eighth year of operation. We started as, and remain, a water company: but to make water you need power, which is in short supply. Utico therefore started selling spare power; we now have 118 MW on the ground. Three years ago, we initiated a long-term strategy looking at alternative energy sources, such as solar, and combined-cycle generation. For a growing utility, you need a mix of fuels and technologies. Our goal is to produce between 500 and 600 MW by 2018, in addition to one million cubic meters of water per day; up from 200,000 today. These goals are very realistic, as we are planning for a combination of organic and inorganic growth, searching extensively for acquisitions.

Utico provided the water, power and sewage for the first of the World Islands project in Dubai, was involved initiating Palm Water and has launched a roughly \$500 million clean coal project. We have always been a pioneering company, especially in unconventional investment projects. Our business model is unique. No company other than Utico has built water and power projects without off take agreements; we are a fully-fledged utility with its own transmission and distribution networks. If any government support was available we would be a much more profitable company, but we are still healthier than most, growing at a compound rate of 35% per year.

What is your view on the regulatory framework for the utilities sector in the UAE?

When you fly on an airplane, you have first, business and economy class. Why is it not the same for water and power? People living in five bedroom villas with Jacuzzi's are paying the same slab as those living in a one-room

studio. The tariff system should be based upon people's lifestyles and what they can afford, and there should be rewards for lower consumption.

Epitomizing the diversification of the UAE's power sector is your clean coal plant. What led to the decision to undertake this project?

The diversification of generation in the UAE is purely the result of a shortage of gas, and the desire to sell it abroad. Other than sunlight, the most abundant alternative fuel source is coal. Unfortunately it is dirty, and as the UAE is a signatory to the Kyoto Protocol we have to do something about this. We embarked on our clean coal project a while ago. 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. The largest carbon capture project in Europe is in Norway, where it is simply used to avoid taxes. Some companies have spent \$100 million on R&D for CCS and not put it to any use.

Utico has managed to find that commercial viability in its clean coal project, bringing together a unique mix of technologies to reduce the operating costs. One of the technologies came from Shanghai Electric, which decided to co-invest in the project around 10 months ago. It has special scientists who have been working on CCS for the last 10 years, and we have exclusive agreements with it for future partnerships in the Middle East.

Does your plant represent a model which could be replicated elsewhere?

Current coal-fired projects around the world need to adapt to reduce their environmental impact; in the United States, for exam-

ple, Obama is against coal. Our project will change the world. We have met scientists from the United Nations, the energy and climate department of the Ministry of Foreign Affairs, the Carbon Capture and Storage Institute and the University of Abu Dhabi. Every single one of them has been transformed from a pessimist into an optimist on this project.

Our 270 MW plant will produce a manageable level of carbon dioxide. CO2 has a commercial value at levels of purity above 96.5%, which CCS projects are yet to achieve. Our project will capture it at 98%, 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.

We understand DEWA is considering further plants?

Dubai has hired McKinsey for a study on a 1,500 MW coal-fired plant; it projects 12% of its power being supplied by coal in the next six years. They are also expecting to use carbon capture, but they still don't know what to do with the CO2.

Utico is working with DEWA on some aspects of clean coal; it can benefit from our co-operation as it investigates carbon capture in its own project. Dubai's Supreme Council of Energy and the Carbon Centre of Excellence are both involved. There are opportunities for us related both to international projects and the feed-in tariffs soon to be implemented here.

If we return in five years for the next report, where will we find Utico?

Utico has had four similar clean coal projects approved in four different countries. In five years the world will be a very different place: coal will be much greener. •



INTERVIEW WITH

Jacco Jansen

EXECUTIVE VICE PRESIDENT AND MANAGING DIRECTOR
NEM MIDDLE EAST

How important has the Middle East become for NEM Group's global family?

The Middle East is very important, in fact the majority of NEM Group's turnover past year came from the region. We have recently secured the PP10 project in Saudi Arabia for 40 Heat Recovery Steam Generators (HRSG) which represents NEM Groups largest contract ever.

What were the key factors in choosing to setup a Middle East office and why did you choose Dubai over other cities in the Gulf?

Firstly to be closer to the customers from a business development and sales side but also for project execution. Secondly, for fiscal reasons, with the tax benefits of having an entity here. Thirdly, it is the availability of highly skilled and fairly low cost staff from the surrounding region, namely India, Pakistan and slightly further, from the Philippines. Dubai is the business capital of the region providing simplicity, support and close proximity to our client base. The only challenge is abundant competition, however as far as we know we are the only major HSRG supplier to maintain a comprehensive office here including engineering support and local procurement, which gives us a higher level of customer intimacy.

Having been involved in the Jebel Ali Power & Desalination Station L, do you anticipate a continued trend towards such co-generation facilities?

Yes we do, combining power and water allows more efficient use of steam and is therefore practical. Also from our standpoint the construction and adaptation of more complex facilities give NEM Group an advantage over lower cost competitors due to our high level of expertise. Our main competitors are companies like CMI, Alstom, Doosan and

Nooter Eriksen but so far only CMI and ourselves have the capability and proven track record in providing vertical HRSG's for oil fired power stations, which have to account for sulphur condensation and hence need a special type of design.

Speaking of oil-fired power stations, do you see your sizable contract for Riyadh Power Plant 10 leading to more contracts in the region?

In contrast to the UAE, Saudi Arabia has a tendency to allocate more gas to industrial plants for high added value products and utilize their abundant oil supplies for power generation. There are a number of new tenders coming up for oil fired power projects in Saudi Arabia, where we would expect NEM Group to be in a good position as the Risk Avoiding nature of Saudi Electricity Company makes them unlikely to take on an unproven or not yet qualified supplier as an 'experiment'.

NEM was involved in the pioneering Al Kuraymat hybrid solar and combined cycle plant in Egypt. How successful has this plant been and do you expect the Gulf countries to adopt this approach?

The plant in Egypt is in full operation now and is doing well, it is one of just two hybrid solar and combined cycle facilities. The solar plant supports power generation with an additional 20MWe during the day using the parabolic trough system and it reverts to a traditional combined cycle power plant during the night. We believe this type of hybrid ISCC (Integrated Solar Combined Cycle) plant has a future, currently the cost is only justifiable with a subsidised feed in tariff but this should change as solar technology advances. Saudi Arabia and Oman are looking at introducing similar systems, in the UAE Abu

Dhabi is leading the way because the mature and privatised nature of their regulatory system which can allow for the subsidising of renewable energy. Our involvement in Al Kuraymat puts us in a favourable position to support the EPC companies looking to take on those projects.

What do you see as the major trend for upcoming tenders in the region and NEM Group's ability to win those tenders?

Major trend in the region is conversion of gas fired plants into combined cycle plants such as the Rabbigh 5 and 7 and Jazan power plant in Saudi Arabia and the power plants in Al Ghail and Al Hamra in Ras Al Khaimah in the UAE. These conversions require a significant investment but the energy gains are around 40%. The payback times are usually around five or six years since combined cycle power generation is still the most efficient way of generating electricity. The competition is much the same for these conversion projects, although many facilities do not provide a traditional space for new elements meaning the expertise of top companies with creative solutions such as NEM Group stand a better chance of gaining those tenders.

Where would you like to see NEM Group Middle East five years from now?

We are looking to increase our market share; we are keen to position ourselves as one of the three leading suppliers in the region in terms of volume. We are looking to expand our office here to 50 to 60 people allowing us to take on at least two major projects a year. Furthermore per project we aim to propose the best global sourcing scenario and to optimise the amount of "local content" in the project. This not only contributes to more sustainability but also supports the growth of the local economies. •

Conventional Energy

Making use of the UAE's resource

While the commitment the UAE has shown to increasing its renewable energy portfolio is admirable in its environmental awareness and impressive in its scope, there is nonetheless a well-known challenge for renewable power: the instability of supply. Even with the rarely cloudy skies of Dubai, the sun does not always shine, yet electricity consumption goes on regardless.

For this reason, any country investing heavily in renewables must have a back-up plan. Or, to put it in the more eloquent words of Lars-Åke Kjell, regional director of power plants for Wärtsilä: "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".

The UAE is in the privileged position of having ample supplies of natural gas, which can provide this fall-back source of generation. Combined cycle gas turbines (CCGTs) have the advantage of being able to ramp up generation quickly, to account for variations in output for other sources, in a way that other energy sources, such as nuclear, cannot.

However, they are not free from problems. 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 penalized 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 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 Wartsila'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." •



Courtesy of NEM

INTERVIEW WITH

G.B.D. Vara Prasad

OPERATIONS MANAGER
PÖYRY, DUBAI

How important has the region Middle East become for Pöyry?

Operations in Middle East started more than 30 years before and specifically in UAE, we started in 1996 before Pöyry's takeover with approximately eight employees. During the boom times, 2007 to 2008, we had up to 110 employees, which again reduced due to the global economic crisis but we have begun to grow again recently. The Dubai office works as the hub in the region. In addition we have offices in Abu Dhabi, Oman and Saudi Arabia. We have high hopes for the UAE specifically, particularly in the Transmission & Distribution market and the nuclear market. Last year our management consultancy practice opened a regional office in Dubai after a long history of serving the region from Europe.

How have you seen the development of demand in the northern emirates?

We have seen demand in the northern emirates. We have also executed a couple of projects. We have seen more activity in Ras Al Khaimah and Fujairah. In Ras Al Khaimah this tends to be with private clients serving the power generation needs of the industrial sector.

How competitive do you find the UAE for your services?

It has certainly become more competitive due to new companies entering the market predominantly in engineering but also in management consultancy. Many of these new companies are smaller and try to compete mainly through pricing, where our strategy is to focus on the quality of our work. This strategy has resulted in establishing strong relationship and repeated business with our existing clients. Many companies want the best combination of both quality and competitive

fee, which is what we offer.

Looking specifically at gas power generation what trends have you seen developing?

Although there is some activity in the UAE gas fired generation sector, the majority of activity for this sector is occurring in Saudi Arabia. The requirement for both water and power is driving this trend in both countries but the scale of expansion is significantly greater in Saudi Arabia. The expansion of nuclear and solar power will lessen the expansion of gas fired generation projects but we will have to see the success and cost effectiveness of this diversification trend in a few years from now.

How is Pöyry preparing for the establishment of a nuclear programme in the UAE?

We have a good relationship with ENEC and have a framework agreement for nuclear services with them. Our management consulting practice has recently finished a ground-breaking strategy study in the interaction of nuclear generation and water production for ENEC. In addition, ENEC is a key client for our engineering business. We have the flexibility to take on a number of roles given the breadth of expertise Pöyry offers in the nuclear sector.

Do you see opportunities in the emerging clean coal sector?

Dubai has made clear their intention to construct a coal power plant. Bechtel has conducted some initial research and a location has been recommended but the availability of coal still creates some questions on how and when this will take place. If and when a coal power plant emerges Pöyry would be looking at it from a consultancy point of view.

How do you assess the development of the UAE's solar power sector?

The climate is ideal for solar but the main issue with the solar industry is the initial investment required and the expected ROI. At this stage, getting clarity on these through a legally binding regulatory framework and clear feed-in-tariffs (FIT) is important. The same goes for wind energy, both these sectors are in their infancy in the region and they will take some time to develop. Pöyry is actively engaged in developing and promoting the sector, and has extensive experience and capabilities from the development in Europe ranging from management consulting to EPCM. We have also been involved in developing the KSA's renewable energy strategy.

Pöyry is known for its expertise in Transmission and Distribution systems, are there many opportunities in this seemingly competitive industry?

There are many opportunities arising through T&D but the market is highly competitive. We consider this to be our main market within the power sector here in the UAE. On the EPCM side of T&D sector, it may not be so lucrative for us due to the competitiveness in the market, however in the power generation side we see less competition. Therefore with T&D we have found it more profitable to focus on the consultancy side.

Where would you like to see Pöyry in five years from now?

There were about 20 new projects that we have or are bidding for this year, from those only four or five have been awarded to date. We are receiving many more enquiries this year in comparison to last year. The prospects were good, so 2013 should be a good year for Pöyry. Within 5 years we are looking to grow from the current staff of 60 to at least 100 in the UAE alone, conducting a variety of detail design and consultancy projects. •

INTERVIEW WITH

Seppo Hautajoki & Lars-Åke Kjell

MANAGING DIRECTOR & VICE PRESIDENT SERVICES
REGIONAL DIRECTOR OF POWER PLANTS
WÄRTSILÄ



How important has this region become for Wärtsilä. Which countries and services do you cover from this office?

LAK: This region has always had a certain importance to Wärtsilä. From here, we cover 14 countries from Pakistan to the Red Sea. It is one of the few regions in the world still using heavy fuel oil for power. Whereas in the UAE the conventional gas power plants are often using light fuel oil in peak times, which is little known by the general population. This creates opportunities for Wärtsilä.

SH: The legal entity here is Wärtsilä Gulf. Regulations specify we must have local partners, with whom we have established various LLC companies. From this office, we cover all of Wärtsilä's business areas. We also have branch offices in Jordan, Yemen, Syria and a Qatar operation set up in November 2012. We have been in Abu Dhabi since 1992, under the current name since 1997, and have made various acquisitions. The company started really growing about 10 years ago, mainly due to the expansion of the service business, which now employs 90% of our 370 staff.

The power plant you have supplied in Ras Al Khaimah is soon to come into operation. Can you give us an update on the project?

LAK: Ras Al Khaimah is a 40-MW power plant, which, according to our Customer UTICO, will be extended in future. Wärtsilä is the equipment supplier and delivered the equipment quite a long time ago. The power plant would commence operation in March or April next year. It will be the first plant in the UAE using gas engines. We are looking forward to see it up and running, as it will then act as showpiece not only for our customer but also for Wärtsilä.

Do you have other power plant projects lined up in the UAE?

LAK: Not much is going on in the Emirates. They have been focusing very much on big power plants. Unfortunately they selected open cycle gas turbines for the daily peaking power load fluctuations which our engines would have been able to handle much better. Our engines produce an efficiency of 42%, while these turbines on part loads are in the range of 20% and 25%, with similar initial investment costs. The mindset is slightly different here from the West: it takes longer to convince people of new technologies, even after they have proved successful elsewhere.

As renewable energy becomes more important in the UAE, will you see the demand for your smart power generation technology grow?

LAK: Under our smart power generation umbrella, we talk about flexible power and flexible operation. To account for the fluctuations of renewable energy, you need plants that can start quickly. The peaks in the load system should be handled more efficiently than they are today: this is Wärtsilä's window to assist with costs and carbon footprint reduction. Starting gas turbines up and then turning them off means higher service and maintenance costs, so there should be a move towards more agile generation. The type of mindset shift we need is already happening in Jordan, which is building a 600MW dual fuel power plant, with 350 base load and the rest for peak time, reflecting the desire for flexibility. As the region moves into an era of smart transmission and smart distribution, some countries would benefit of using responsive generation or smart power generation.

Do the new heat storage capabilities of solar plants mean a reduction in these fluctuations?

LAK: The biggest problem today in the energy world is the storage of electricity. There are many possible solutions, but not yet a

complete one. Until this happens, solar and wind power can never guarantee to react to the demand. When people discuss peak loads they normally compare summer to winter, but often they overlook the fact that there is a 30% difference between max and mean daily power usage, which cannot be easily managed by solar or wind.

How competitive is the market for these flexible power generation systems?

LAK: The challenge is that when there is a tender, it is evaluated on a power plant basis. We are saying it should rather be based on how it improves the grid system. Too much attention

is paid to the highest loads, whilst the fluctuations and responsiveness is being ignored, which in the end will save on fuel costs. Maybe there should be differences in the pricing of tariffs for peak and base load plants. Although fifth in the world for delivering power, Wärtsilä is small compared to its competitors: we deliver 3-4 GW per year, compared to 50 to 60 GW totally on a global basis. However, we are not playing exactly the same game as GE or Siemens with their CCGT installations. While CCGT is the most efficient producer of electricity when it comes to base load, our technology is world-leading when talking about handling quick load changes in a grid system.

You are more specialized than your competitors in the gas engine sector. Does this give you an advantage for those tenders?

LAK: We aim to change the mindset of the utility companies and get our technology approved for tenders in this region. With the private sectors through IPPs like in Ras Al Khaimah, we have no problems.

Where would you like to see Wärtsilä UAE's power plant division in five to ten years?

LAK: Power plants between 100 MW and 400 MW are very suitable for our combustion engines, and this is where we would like to see our technology. •

HELLO UNITED ARAB EMIRATES,

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ENERGY ENVIRONMENT ECONOMY

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Diversification of Energy Resources in the Middle East

The Emergence of a Green Sukuk

The Middle East and North Africa (MENA) region is the richest region in the world in terms of natural resources, holding more than 60% of global proven oil reserves (mostly in the Gulf) and almost half of gas reserves. This is not necessarily a blessing. Substantial literature on economics, combined with an unfortunate plethora of real-world examples, has proven the downsides for resource-rich countries; the infamous “Dutch Disease” where dependence on one natural resource may cause inability to diversify an economy and, as oil accounts for 80% to 85% of exports from the region, a vulnerability of its countries to being affected by volatile commodity prices.

Aware of this danger, several countries have chosen to diversify their energy sources. An excellent example of this is the UAE, which in 2009 signed a \$20 billion contract with Korean firms to build a nuclear reactor. The Korea Economic Institute called this investment “strategic” as demand for nuclear technology and energy is expected to rise in the future, with several of the world’s nuclear reactors soon to retire. Abu Dhabi’s move to diversify resources away from natural resources could not have come at a better time.

The UAE is often associated with spear heading modernization in the Middle East. In its Economic Vision 2030 the country explains its aim to expand growth and reduce its oil share of GDP to less than 40% by stimulating new sectors such as renewable energy, technology and aerospace. By launching the multibillion-dollar Masdar initiative it is establishing itself as the regional leader in green technology and innovation. Other MENA countries are adopting their own diversification programs: Saudi Arabia is planning to invest \$109 billion in clean energy to supply a third of its total domestic power generation; Kuwait has target to generate 10% of its electricity using sustainable energy; and Qatar announced plans to build a \$1 billion polysilicon manufacturing plant. Jordan, Egypt, Moroc-

co and Algeria are also following the trend and have launched cleaner energy agendas, which combined amount to \$25 billion to \$45 billion in long-term investments that will finance “green energy sources” such as wind, solar and nuclear energy. These projects are predicted to power 10% to 20% of their respective energy portfolios by 2020.

In countries where oil and gas resources are abundant, distortions in prices are high and recovery costs in electricity are low, which allows for high and inefficient energy intensity in energy use, increasing environmental problems and in some cases putting pressure on government finances. The benefits of diversification are clear: lower risks of dependence, environmental sustainability, efficiency in domestic consumption and higher revenue from fossil fuel exports. Higher oil prices have also encouraged the oil giants to build a renewables industry in the region to avoid burning cheap oil domestically and benefiting by selling more in the international market. In order to allow companies, entrepreneurs and even governments to finance these colossal and expensive projects, Sharia (Islamic law) compliant financial instruments are needed.

Islamic Finance 101:

Bonds, in a nutshell, are financial instruments of indebtedness. By using a bond the issuer owes the holder a debt that accrues interest depending on the terms and maturity of the bond. In short, bonds are loans. Sukuk is an Islamic financial certificate that is Sharia compliant and, unlike Western bonds, the payment of interest or *riba* is not allowed. When issuing a sukuk the issuer sells a certificate to an investor group who then rents it to the issuer for a rental fee by making an additional contractual “promise” to buy back the sukuk at par value in the future. The nature of the sukuk is to avoid indebted trading, which is banned under Sharia, and to link returns and

cash flows of financial activities to the assets purchased. This means that a sukuk can only be raised to finance identifiable assets because they represent undivided ownership shares of a tangible asset, project or investment activity. Since the first sukuk was issued in Malaysia in 2000, the popularity and availability of sukuk has increased and governments and the private sector use it as a source of alternative finance to fund long-term projects.

Green Sukuk:

Nasser H. Saidi, Chairman of the Clean Energy Business Council, has stated that the MENA region has enormous potential for renewable projects and stressed the need to put in place policies and a regulatory framework that enables and facilitates these projects. There is currently no institution that specializes in clean energy finance, although the Clean Energy Business Council and The Gulf Bond and Sukuk Association have launched a green sukuk working group that aims to provide expertise to develop best practices and the promotion of sakk to finance renewable energy projects. Issuing green sukuk will support the region’s green energy trend and developing strategies by expanding currently available financial instruments.

A green sukuk will establish a connection between Sharia compliant investors and environmentally focused investors. The sukuk market is suited to mobilize funds from a vast pool of Sharia compliant capital to fund renewable and sustainable energy projects and The Clean Energy Business Council estimates the value of green sukuk issuances to be at \$10 billion to \$15 billion if even just a fraction of the projects in MENA were to be financed by sukuk. Launching a green sukuk to finance green energy projects will attract investments from private equity investors looking to diversify their investment portfolios in countries that are looking to diversify their own energy portfolios. •

Utility Tariffs in the Middle East: Rewarding Responsibility

Richard Menezes, Managing Director
Utico

In the Middle East, planning and setting utility tariffs is never a simple act. Every decision made leads to multiple cascading ripple effects. In truth, however, tariff setting should be based upon a simple principle: a consumer’s right to choose. It should not be based upon the amount a consumer can pay, but on what they choose as a lifestyle.

Elements of this may sound absurd, given that it represents a fundamental change from the current reality of tariffs in the Middle East. Yet the current reality is unsustainable. An acceptance of a consumer choice-based tariff structure will lead to a more sustainable utility model. This may result in a lower, or even zero, subsidy for consumers, yet it will also lead to better quality of service, a greener environment and higher economic growth.

The present system of tariffs, in the UAE and throughout the region, is based upon indifference: it helps those who are irresponsible in their water and electricity use rather than benefiting those who are responsible. It is based upon the acceptance of energy waste as a norm. It does not offer the consumer a choice, but rather brackets them in classes.

What is the easiest way to offer a choice to consumers? I would put forward that tariff slabs should be based on dwelling type. Utilities are, essentially, a service to a dwelling rather than an individual. The dwelling of an individual, to a large extent, determines their consumption and lifestyle. They are also easily identified: all dwellings in the UAE are municipal build permit-registered and hence records exist.

Just as airlines offer a choice of economy class, business class or first class, and telecoms offers its customers different levels of plans differentiated by value-added services, a person’s utility tariffs should be differentiated in the same manner. Dwellings should be divided into classes; for example, economy, ordinary

and luxury; with the dwelling type setting intent of supply. All consumers must be offered a luxury high-use, high-tariff model with an equivalent rebate model, as well as an ordinary model that offers low-price, low-consumption limits but also a rebate for being below limits. The idea that water and power are basic services, and as such somehow distinct from other service offerings such as telephone, internet, transport, diesel and so on (all of which offer consumers such a choice), is rapidly becoming obsolete. A modern professional is no more able to live without their mobile phone, internet and car than they can without water and power. It is time to differentiate between our utility offerings in the same way we differentiate between our offerings in any other service... and it is time to stop being indifferent. Why is this important? Because it will shift the focus of the current utility market from the supplier to the entire value chain. It is only by doing this that we can make any progress towards a greener society. “Going Green” starts from the consumer being more energy efficient (reducing, reusing and recycling), not from simply using more renewable technologies in power generation. Even today, solar and wind electricity generation remains very capital intensive and land intensive compared to conventional fossil fuel-based generation.

A change in tariff structure and the presentation of more choice to consumers will, in addition, focus generation on what works. Conventional power, for example, can greatly reduce emissions and build efficiencies by installing carbon capture. In coal generation, carbon capture can reduce costs of electricity and water production by 25%, as well as reducing the carbon footprint of a coal-fired plant to lower than that of a natural gas-fired plant. In addition, it generates 50% more employment, produces high-quality high-yield nitrogen fixing fertilizer and high-quality

CO2 for enhanced oil recovery.

Changing the tariff system to present more options for consumer choice will still have multiple ripple effects. In this case, however, they will be beneficial. In providing a stimulus to clean coal and carbon capture it has the potential to generate between 200 and 350 direct jobs per site (150 MW and above) and thousands of indirect jobs through its support of new industries both downstream and upstream. The production of fertilizer as a by-product of these plants it stands to create an agricultural revolution in the Middle East. It will also help in Demand planning since Suppliers will know the High users from Low users clearly by their package.

In today’s world austerity stands out, from the stagnant economy of the US to the debt crisis in Europe. People are realizing that the state cannot indefinitely sustain the provision of “free” support without its citizens providing equally important support by reducing waste, improving efficiency and promoting discipline and accountability. The Middle East, and its utilities sector, is no exception. The removal of subsidies may initially be unattractive to consumers, but the rebate will actually provide them a new source of revenue, conversely it will lead to a drop in utility costs as also saved utility capacity can be used to serve more consumers.

Austerity in power and water is an investment, and like any investment it pays a rate of return. The Regulation and Supervision Bureau should register those who want to participate in utilities austerity and reward them for continued participation. A consumer cutting his utilities use by 10% per day continuously and setting his peak limits set point lower could earn year-end rate of return benefits of 10% to 15% per annum. And the reduced cost to the state and the environment means that everybody benefits. •

Complementing Production: Transmission and Efficiency in the United Arab Emirates

"The power needs here are ever increasing, and the UAE has understood that they need to play the green card to remain competitive, so they are looking into renewables and nuclear. A challenge for the region is to build up modern transmission and distribution network with high intelligence and latest state of the art efficiency... The challenges that transmission faces include high temperatures in summer and the high load. People here are also not very conscious of energy usage: they leave the lights on and constantly run air conditioners."

- Hendrik Cosemans,
GENERAL MANAGER, NYNAS AB MIDDLE EAST



Grids in the Desert

Transmission systems in the UAE

The current electricity grid in the United Arab Emirates is slightly fragmented, being operated by state-led entities in each of the seven emirates. Although it is certainly not an inefficient system, neither is it as efficient as it could be. Yet the UAE is nothing if not ambitious and it is arguably in this area of transmission and distribution that the country shows the most potential to be on the cutting edge of global power technology.

Within the UAE the transmission and distribution network substantial progress is being made to integrate the seven individual authorities into a more efficient national grid; essential to allowing the UAE's grid to keep pace with the growth and development of the sector. With the increasing diversification of the power generation sources, many of them with the intermittent output characteristic of renewables, the country is also investing heavily into the concept of the smart grid.

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 capital expenditure investment for new projects, Dubai on operating expenditure 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.

Issues of both usage and generation are not

solely a key issue for the UAE, however: they are themes that run through the entirety of the Gulf Cooperation Council (GCC) and the Middle East regions. In line with this, the region is now planning for an unprecedented level of cross-border power interconnection. The GCC's Interconnection Project (GCCIP) is an undertaking of unprecedented scale linking the electricity grid in six Middle East states (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the UAE). It was conceived 30 years ago, received the official go-ahead in 1999, and the third and final phase was completed in early 2012, although there is speculation that the grid may be further expanded. Although physical connection is essentially complete, 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. The amount of work being done and the stated ambitions of the government ensures that there will be a continuous stream of new projects across the power sector for companies with the necessary expertise and technological capacity. Nonetheless, the competition will remain fierce for some time in such a congested market.

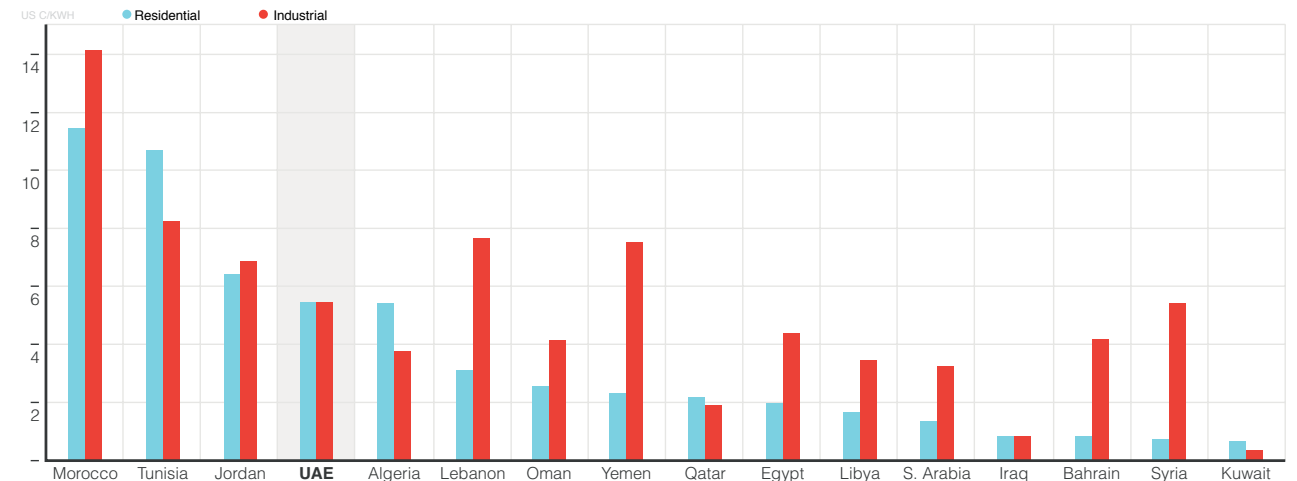
Electricity Consumption and Installed Capacity (1980-2008)

Source: EIA

	ANNUAL CONSUMPTION (TWH)				INSTALLED CAPACITY (MW)
	1980	1990	2000	2008	
Bahrain	1.45	3.04	5.36	10.48	2,777
Kuwait	8.10	18.13	27.33	42.58	10,944
Oman	0.80	3.70	7.03	13.25	3,991
Qatar	2.03	4.28	7.95	18.79	3,164
Saudi Arabia	29.10	60.91	109.49	174.48	39,242
UAE	5.46	14.52	36.20	70.58	18,474
TOTAL GCC	36.93	104.57	193.35	330.15	78592.00
Average Growth per Decade	-	183.2%	84.9%	70.07%	-

Residential and Industrial Electrical Prices in Arab Countries (2008)

Source: EIA



The UAE's Global Competitiveness Rankings (2012/2013)

6th

Quality of Overall Infrastructure

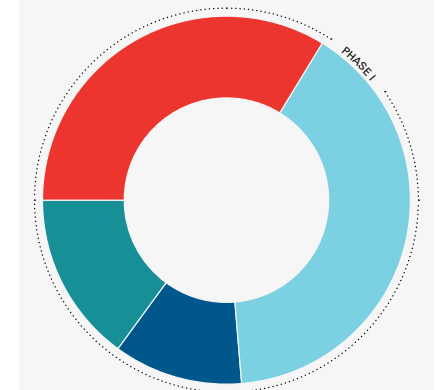
20th

Quality of Electricity Supply

Source: World Economic Forum

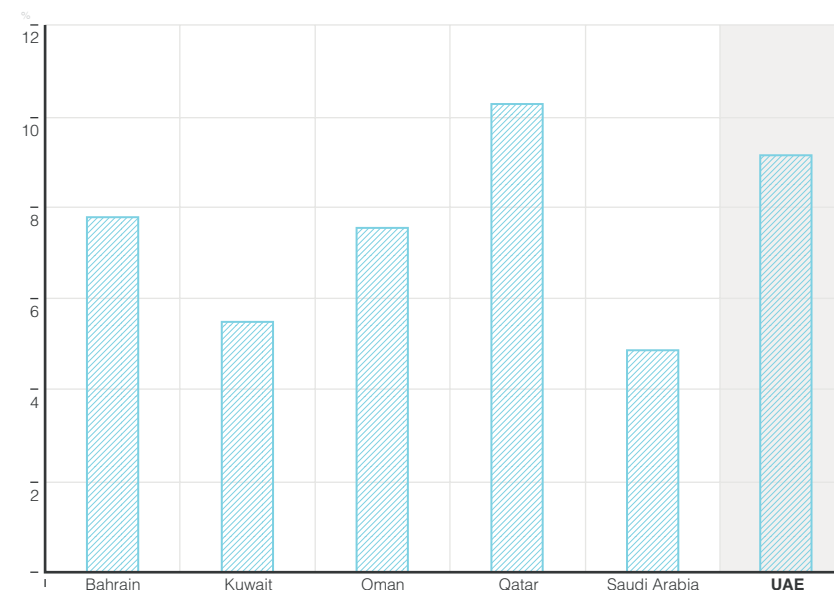
Ownership Structure of the GCC Interconnection Grid (Phases I & III)

Source: Bloomberg

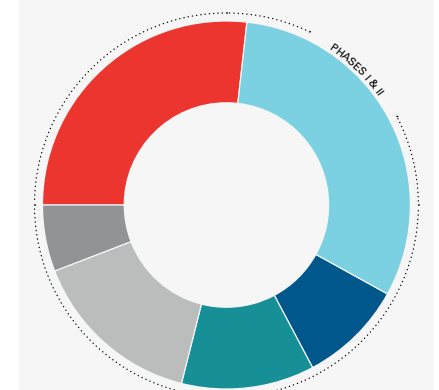


Estimated Annual Electricity Consumption Growth Rates (1999-2009)

Source: EIA, Oxford University



	PHASE I	PHASES I & II
Kuwait	33.8%	26.7%
Saudi Arabia	40%	31.6%
Bahrain	11.4%	9%
Qatar	14.8%	11.7%
UAE	-	15.4%
Oman	-	5.6%



Gulf Cooperation Council Interconnection Project

Source: GCCIA

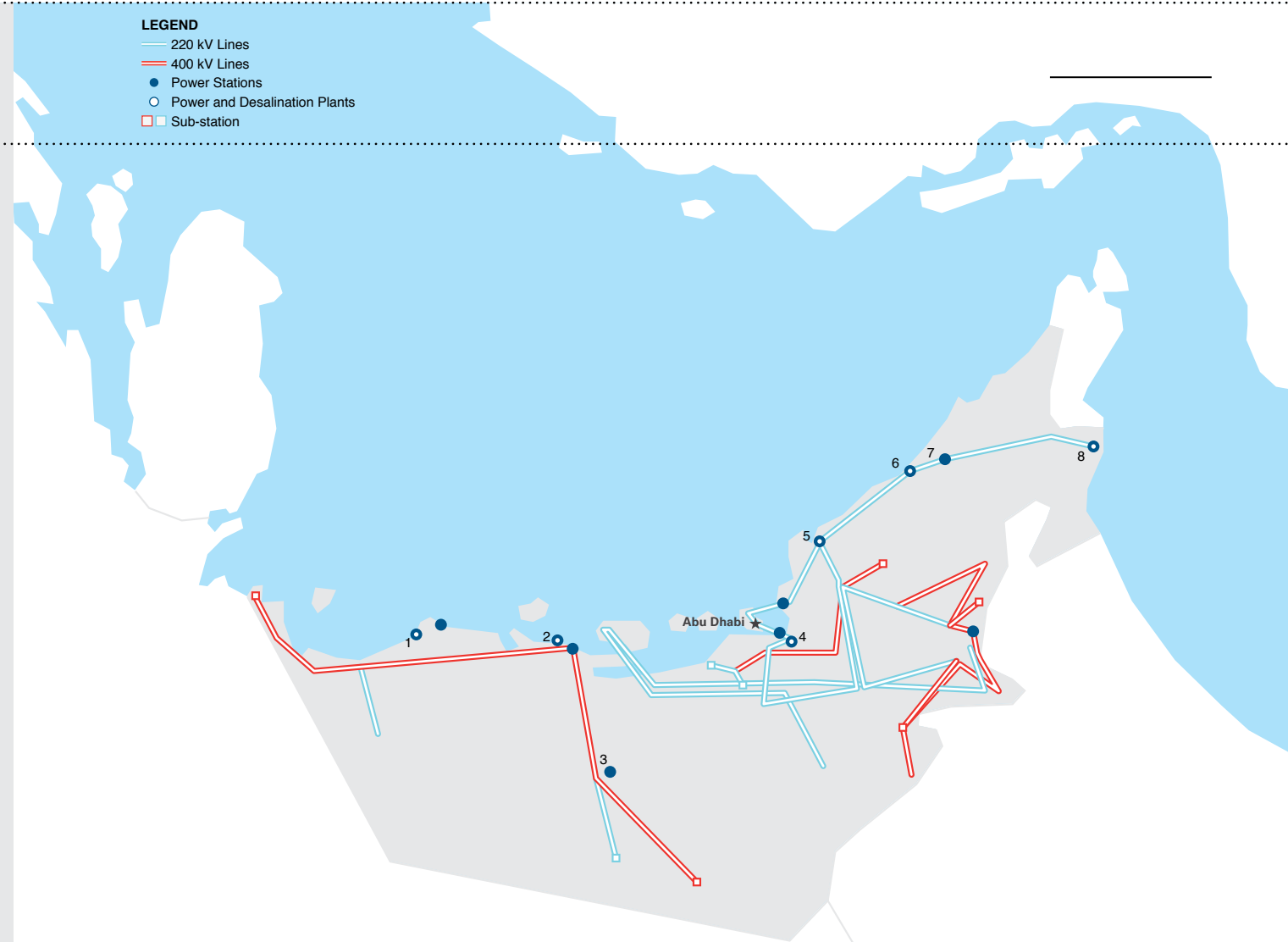
- LEGEND**
- GCC power grid
 - UAE system (ENG)
 - Control Centre
 - Substations
 - HYDC converter



United Arab Emirates Electricity Grid

Source: EU-GCC Clean Energy Network

- LEGEND**
- 220 kV Lines
 - 400 kV Lines
 - Power Stations
 - Power and Desalination Plants
 - Sub-station



① **Shuweihat 1 IWPP**
Electricity (MW): 1,615
Water (1,000 cm/d): 459

② **Shuweihat 2 IWPP**
Electricity (MW): 1,627
Water (1,000 cm/d): 459

③ **Shuweihat 3 IPP**
Electricity (MW): 1,647

④ **Mirfa**
Water (1,000 cm/d): 177

⑤ **Shams 1 solar IPP**
Electricity (MW): 100

⑥ **Umm al-Nar IWPP**
Electricity (MW): 2,430
Water (1,000 cm/d): 659

⑦ **Taweelah A1 IWPP**
Electricity (MW): 1,671
Water (1,000 cm/d): 386

⑧ **Taweelah A2 IWPP**
Electricity (MW): 760
Water (1,000 cm/d): 232

⑨ **Taweelah A3 IWPP**
Electricity (MW): 2,220
Water (1,000 cm/d): 732

⑩ **Jebel Ali**
Electricity (MW): 6,888
Water (1,000 cm/d): 1,819

⑪ **Al-Awir**
Electricity (MW): 1,834

⑫ **Fujairah 1 IWPP**
Electricity (MW): 861
Water (1,000 cm/d): 454

⑬ **Fujairah 2 IWPP**
Electricity (MW): 2,114
Water (1,000 cm/d): 600

INTERVIEW WITH

Pradip K. Das

GENERAL MANAGER
GULF JYOTI INTERNATIONAL

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Could you begin by providing our readers with an overview of the corporate structure of Gulf Jyoti International (GJI)?

Gulf Jyoti International (GJI) is a company jointly owned by Gulf Investment Corporation (GIC) in Kuwait and Jyoti Structures Limited (JSL), India. GIC is a financial institution owned by the governments of the six GCC countries, while JSL is a company that has been a pioneer in the field of transmission and distribution for the last 35 years, and has implemented projects in over 40 countries across the globe. The GIC has a mandate to invest in infrastructure projects across the MENA region, but it needed a technical partner, so it partnered with JSL India. This was how GJI was founded in 2005, and we began production in July/August 2008. I joined JSL 24 years ago and took charge of GJI in June 2009.

What are some of GJI's main service lines and business areas?

GJI was established to do business in the MENA region, focusing on EPC work and supply: we have one of the most modern factories in the world, and having annual production capacity around 50,000 tonnes of galvanized steel structures for transmission lines and substation structures.

Has GJI been primarily focused on the MENA region or do you also seek contracts outside the region?

We have had contracts across Tunisia, Algeria, Libya, Qatar, and Turkmenistan, to name a few apart from DEWA, Dubai. Although we primarily work in the MENA region, we also examine projects outside of the region on a case-by-case basis. For example, JSL acquired a contract with the San Diego Gas Electric Company, which we were involved in. The main challenge that we face is the slowing down of the MENA market; the market is not flourishing at the moment. Due to the Arab Spring, things are slow in certain MENA countries. We are however looking forward to doing business in Iraq in the future.

What is the importance of certifications to the company, and how do they provide you with a competitive advantage?

Certifications are essential for operating in the region. We were recently awarded the 'Green Award' by the Government of Dubai. GJI is an ISO 9001:2008, ISO 14001:2004 & OHSAS 18001:2007 certified company. Companies need to be ISO certified to do business here. This was a challenge for us in the beginning, but with our dedicated team we overcame this challenge. We have also been inspected, audited and approved by American and Canadian utility companies.

What advantages has the GIC partnership provided you with? Has it given you increased credibility with authorities such as DEWA?

In order to obtain contracts we have to go through the competitive bidding process, so credibility is not really an advantage. That said, the GIC does help us receive support from the banking and administrative sectors, as well as in receiving duty exemptions.

We have seen a stark difference in the structure of the power sector in each different Emirate. Can you comment on this?

Companies need to go through a separate registration process to start doing business in each. In Abu Dhabi, for example, it is not enough to be registered in Dubai. We have registered as a local company in Abu Dhabi, and have submitted the dossier to be registered as an EPC supplier. Abu Dhabi has a great potential for growth.

What challenges does diversification in the power generation supply bring for transmission and distribution?

We are fortunate to be in the T&D sector, because no matter the energy source (thermal, solar, hydropower, gas, etc) transmission lines are required. Recently we were invited to become DEWA's exclusive partner in conducting all of their maintenance work and doing emergency restoration jobs; we recently finalized our MoU and by the end of January 2013 we should be signing the contract. In Dubai there is a huge network of transmission lines that requires regular maintenance and emergency restoration work. •

INTERVIEW WITH

Floris Schulze

MANAGING DIRECTOR
CESI MIDDLE EAST

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How important is this region becoming for CESI globally?

CESI Middle East officially launched in Jan. 2012 because we believe that the MENA region, and more specifically, the GCC region will play a significant role as a powerhouse energy source with the capability to fulfill the world's future energy demands. From an R&D and investment perspective, the Middle East is a strategic hub for CESI and will become increasingly important over the next five years as the need for advanced electrical grids to support the growing population and industrial needs grows. The Middle East embraces innovative technologies and its recent developments are a perfect example of this – just look what Saudi Arabia is doing with the development of a national strategy for smart grids and smart metering. It's likely that some of these GCC countries will soon become a world leader in the energy sector.

CESI has been active here for some time. How has the new office helped?

CESI established a local presence to help build relationships, enhancing effectiveness and responsiveness of regional operations, tailor-made solutions and daily communication with clients. Our Dubai office, supported by CESI's global footprint, represents a long-term commitment to this region. One month after launching our Middle East office, we were awarded a prestigious project by the Arab Fund, to carry out a feasibility study for developing a single energy market between 20 Arab countries, the development of a national strategy on smart grid and smart metering for The Kingdom of Saudi Arabia by the Electricity & Cogeneration Regulatory Authority and the development of a highly specialized HVDC interconnection link between Central and Western Region (Riyadh and Mecca) by Saudi Electricity Company.

Can you give us an overview of CESI's operations in the UAE?

While we have numerous pipeline opportunities in the UAE and have been involved in interconnection projects in the UAE in the past, we do currently don't have any that ongoing. We would like to participate in the ongoing developments on solar energy in in the UAE initiated by DEWA and Masdar City and, looking at our state of the art expertise and references, would like to take part in the development of Smart Grids and Smart metering strategies for Abu Dhabi and Dubai. The overall awarding process of projects in the region take longer than in Europe, but the future of the Middle East looks very bright as the energy sector is still being developed.

CESI is also one of the top three suppliers of high efficiency solar cells in the world. Will these come into the Middle East market in the long term?

CESI has a dual presence in solar power. We consult on the integration of renewable energy into the grid – quite a specific task – and are also developing our own high-efficiency solar cells, which we hope to introduce into the Middle East market in the medium term. I expect, with our R&D and the investments of other key players in the region, there will come a time when the large-scale use of renewables becomes economically viable here. Such alternatives would be an advantage for Arab countries, allowing them to use their oil and gas for other purposes.

Tell us about your work with Masdar. How do you view the environment for foreign investment in what is becoming a very crowded solar market?

Our involvement with Masdar City has not yet been finalized – at this time, it's just an opportunity we have been offered. No decisions have been made yet. CESI is not a full scale contracting company that builds solar plants, so our services will be consultative in nature and the sales of high efficiency solar cells. However we are willing to invest in new technology developments and pilot studies. Like Saudi Arabia, the UAE is trying to develop solar technologies alongside companies like CESI; this is great because rather than just buying solar cells, the country wants to invest in an energy knowledge domain. For us, it is the ideal opportunity

to lead as the energy expert and collaborate with other key stakeholders outside of regulators and energy companies, such as academic institutions.

What role do you see yourselves playing in transmission and distribution?

We have very specific HVDC knowledge, which is being applied in Saudi Arabia, to gain extra capacity and secure emergency supply. Our long-term role will relate to the integration of renewable energy, which also requires specific expertise. Solar energy will take time, but the grids should be prepared in advance. The last task will be connecting the entire GCC, North Africa, the Mediterranean area and northern parts of Europe, which is the goal of our Renewable Energy Sources for the Mediterranean or RES4MED research. Through a collaborative effort alongside leading global energy players, CESI aims to promote renewable energy sources and to analyze the conditions for integrated electricity markets that will support the energy demands of the anticipated 10 billion population in the above regions in 2050.

In partnership with Ramboll, CESI has been tasked to help realise an energy trading solution for the Arab countries. Can you tell us more about this?

Our Arab Fund energy-trading project is not only interesting but also prestigious. CESI's goal is to undertake feasibility studies to create a single-energy source across 20 Arab countries. A true pan-Arab socio-economic initiative the League of Arab States is really committed to making this project a success. As the world observes, there is much at stake for individual participating countries, including trade opportunities and energy security. We are looking at gas as well as electricity trading, from both economic and technical points of view, and are also evaluating regulation. There is still much to accomplish, but we are pleased with the results attained so far. Part of what makes the project exciting is that the Middle East region 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. The reputation and contacts we will gain from being part of these developments will cement our long-term business partnerships for CESI in the Middle East. •

GULF JYOTI INTERNATIONAL

Turnkey Solutions

Gulf Jyoti International LLC (GJIL), a Dubai based Engineering, Procurement, & Construction (EPC) contracting company for EHV Power Transmission Line, Substation, Telecom Tower, Distribution and underground cabling, jointly owned by Gulf Investment Corporation-Kuwait and Jyoti Structure Ltd.-India.



GJIL is an ISO 9001:2008, ISO 14001:2004, & OHSAS 18001:2007 certified company having a state of the art fabrication & galvanizing plant in DIP, Dubai-UAE with annual production capacity of 50,000 MT of galvanized steel structure, mainly to cater to the power demand for MENA, CIS & Europe region.

ISO 9001
ISO 14001
OHSAS 18001
Certified Company



www.gulfjyoti.com

INTERVIEW WITH

Cor Corbeek

GENERAL MANAGER
EMERSON PROCESS MANAGEMENT - MIDDLE EAST AND AFRICA

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Could you please provide a brief overview of Emerson Process Management?

Emerson Process Management is an American company of about 130 years old. Headquartered in St. Louis, with factories and offices in around 130 countries, we are currently worth \$24 billion. The group employs 130,000 people. In the Middle East, our headquarters are in Jebel Ali; our office in Abu Dhabi supports the UAE specifically, as well as Oman and Egypt. We continue to invest in our manufacturing hub for the region, located next to the Dubai headquarters, with current plans for another \$33 million expansion. We have other regional offices throughout the Middle East and Africa.

You cover a number of industries, but how important is power to your operations in the UAE?

Power is very important to our UAE operations: it links into all our business sectors. Energy demands are increasing, and the Abu Dhabi government also needs the gas to re-inject into oil reservoirs. There are great opportunities for Emerson Process Management both from new gas exploration and the construction of new and more efficient power plants; we play a role in everything from measuring to control, optimization and efficiency. Environmental awareness in the country is growing, creating additional opportunities in such areas as the analysis and reduction of gas emissions.

How important is this region becoming for Emerson Process Management globally? What have been some of your key projects so far in the power industry?

The Middle East, and the UAE specifically, is seen as a big growth area for Emerson Process Management. This is why the group continues to invest and add new people. We are working

with most of the federal power companies: FEWA, SEWA, DEWA and ADWEA. We are also working with the upcoming nuclear plant. There is no one standout project, because we are involved everywhere. New gas plants will mean new opportunities for Emerson Process Management, but at the same time we are working with Masdar on their projects

Does Emerson Process Management have a role to play in the drive for gas efficiency anticipated here? Has the government prepared adequately for it?

Emerson Process Management has solutions to help customers improve efficiency, reducing losses and costly shutdowns; our equipment is instilled with the intelligence to predict where things will go wrong. The government has created an adequate framework. It has moved towards IPP plants, which put the onus on the private sector to make generation efficient.

Ambitious solar targets have been set but as yet there are few projects on the ground. When do you expect to see the market boom?

The government is serious about solar power and alternative energies but delays have taken place. Abu Dhabi has its 2030 vision laid out, the investments will happen so the boom will have to come. Perhaps there was a slight underestimation of how big these projects really are, and how many can be executed concurrently. The global downturn has not helped: Abu Dhabi lost a lot of money, and has become a little more cautious. The Emirates' renewable targets might be possible, however; they have the resources available if someone can take the initiative.

Emerson Process Management is taking a somewhat opportunistic approach to the alternative energy sector here. We are working on carbon capture storage (CCS) projects, and are bidding for solar plants in Oman. Our in-

volvement in these projects solar plants will be with EPCs, rather than the authorities, and will feature collaboration with our sister companies, Emerson Network Power and Emerson Industrial Automation, which have equipment and solutions specifically for renewable energies, such as AC/DC inverters.

Along with reducing gas dependence, CCS can also reduce CO2 emissions into the atmosphere. Tell us more about your carbon capture storage solutions?

The carbon capture storage project is a good opportunity for us, offering involvement across the value chain as the gas is produced, cleaned, collected, transferred and re-injected. Initially there will be only a few places where carbon is collected, but ultimately it will spread throughout the region. It could help the UAE reduce its gas dependency. Like other Masdar projects, however, it has been scaled down somewhat since its introduction.

Where would you like to see Emerson Process Management in this market three to five years from now?

We embrace healthy competition, and it is very tough here with all our major rivals present. Our current expansions, scheduled for completion within two years, will make Dubai even more of a hub for our Middle East and Africa operations, and will perhaps even make us a global exporter. In this timeframe, we expect there to be more downstream petrochemical projects in Abu Dhabi. •



Commitments to the Environment

Promoting efficiency in a power-hungry market

.....
Seasonal fluctuations in the UAE's electricity consumption see significant disparity. Residential and commercial power demands experience huge increases during the hot summer months, as companies and families stave off the 40°-plus heat with liberal use of air conditioning systems. The challenge of maintaining a ski slope or ice rink, both of which are contained within Dubai's many malls, becomes all the more energy consuming when July temperatures can reach close to 50°. Nick Carter, director general of Abu Dhabi's Regulation and Supervision Bureau, explains the challenges this causes: "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 buying their electrici-

ty,” explains Ahmed Sfar infrastructure business VP at Schneider Electric. The Gulf Region sits on the cusp of a power revolution, with investments in the sector estimated at over \$250 billion in the next five years. The plans and success of the UAE with regards the application of new energy sources, the balancing of a diversified power sector and perhaps most crucially the style of financial and regulatory regimes are arguably leading the region in this revolution. With the next five to 10 years crucial in shaping not only the UAE power sector, but the GCC and the wider Middle East region, we should hope that Dubai and Abu Dhabi concentrate as much on reducing consumption and promoting efficiency as they do on creating new generation. •

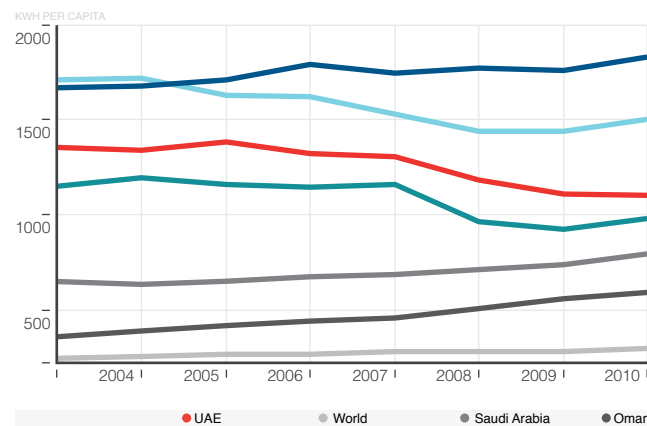
Climate of Dubai (the need for air conditioning)

Source: World Bank

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
AVERAGE HIGH °C	24.0	25.4	28.2	32.9	37.6	39.5	40.8	41.3	38.9	35.4	30.5	26.2
AVERAGE LOW °C	14.3	15.4	17.6	20.8	24.6	27.2	29.9	30.2	27.5	23.9	19.9	16.3

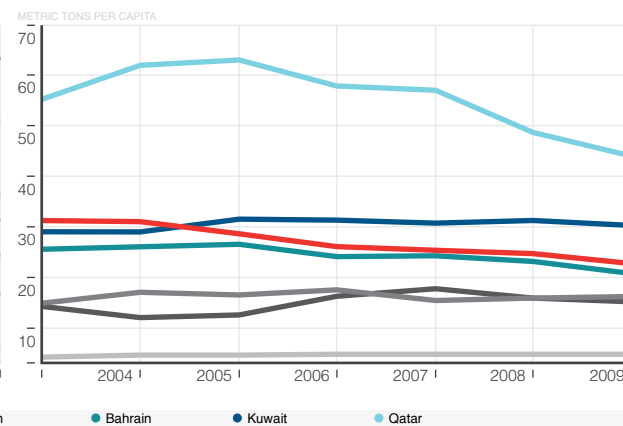
Electric Power Consumption per capita

Source: World Bank



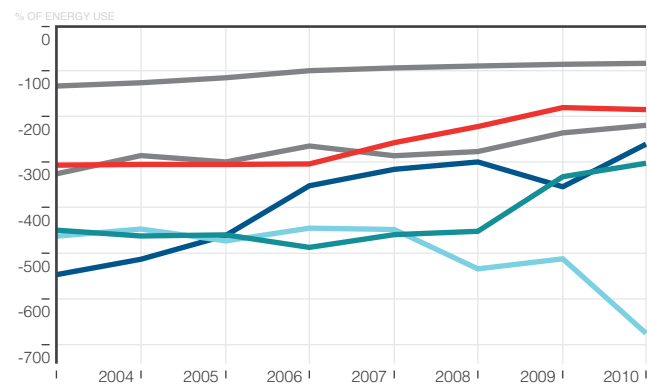
CO2 Emissions per capita

Source: World Bank



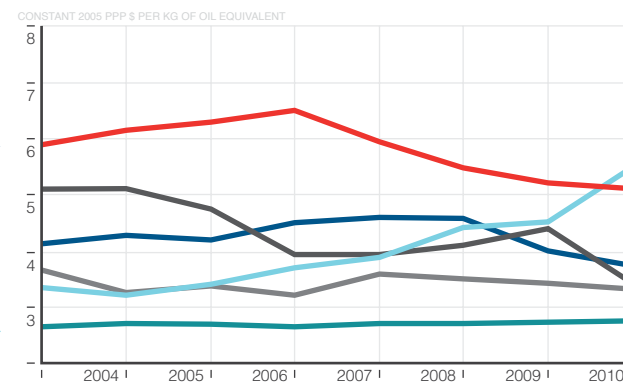
Net Energy Imports

Source: World Bank



GDP per unit of energy use

Source: World Bank



INTERVIEW WITH

Michael Krämer



SENIOR ASSOCIATE
TAYLOR WESSING

What measures do you believe are needed to encourage the solar industry in the UAE, whether a reduction in subsidies to gas or an implementation in subsidies for solar energy?

It is difficult to answer the question of whether the UAE government should increase subsidies to solar or decrease subsidies to gas. The real cost of electricity in the UAE is not openly disclosed and would require agreement on which costs have to be factored in to such cost anyway. At present, electricity in the UAE is mainly produced by gas power plants, which are fed with natural gas from Qatar. Qatar supplies the UAE with such natural gas at very low prices. This is what solar energy generation has to compete with. That being said, for the time being I believe the payment of incentives for private investors will be required, but the result will be less dependency on Qatar. Such complete dependency on Qatar is not a good situation for the UAE to be in to start with and solar technologies are ideally suited to complement the energy mix, particularly in countries with as much sun as the UAE.

If we assume that Qatar will continue to supply low cost gas to the UAE in the future, how will this impact the viability of renewable energy?

The reason why Qatar supplies such low cost gas to the UAE is somewhat unclear. Qatar could easily sell the gas at much higher prices to other countries. The supply agreement between the two countries should end in the foreseeable future, and the question will be: what is the incentive for Qatar to renew this agreement? At the time of the initial agreement, Qatar did not have the facilities to liquefy natural gas in order to export it to other regions such as China or Japan. However, the liquefying facilities are now in place and

Qatar can now potentially export it at higher prices. Hence, the UAE will have to diversify its energy mix sooner rather than later, so why not make use of solar as an energy source that is available in the UAE in abundance?

With the rapid growth in the demand for power in the UAE, is the attention on large-scale power generation projects rather than small, as in renewables?

From the government’s point of view, it is much easier to maintain a centralized power generation system. It is a bit more daring to let private investors generate their own electricity. However, the government need not make a choice between small or large-scale projects, it can focus on large-scale power generation projects, while at the same time opening up the market to private, small scale investors. After all, real capacity building is done by private investors in small to medium scale installations, not by the few investments in utility scale sized plants. Currently, generating electricity from solar is more expensive than what individuals are accustomed to paying to DEWA. Thus, private solar investments will require an incentive scheme. I have suggested an incentive scheme whereby the self-consumption of self-generated electricity is being incentivised. No tariff is being paid for energy being fed into the grid instead of it being self-consumed where it is being produced. This scheme would create a natural ceiling, keeping solar investments at a certain level, bearing in mind that the energy consumption in the UAE is about ten times higher than in Europe anyway. The advantage is that the utility companies do not have to worry about the grid, the system requires much less infrastructure. Some have asked why we would want to restrict solar energy production. My answer is that we need to get

familiar with the technology first; if such a scheme works for five years, the cap can be removed and we can incentivize production going into the grid, but we need to build confidence first.

The UAE has a largely transient population, would this issue affect the scheme?

That demographic issue is certainly one of the limiting factors. Investments in solar are only really sustainable to homeowners that plan to live in their homes for a few years, which means that the system would have to be adapted to mobility. One solution could be that landowners install the systems and charge additional amounts from their tenants (which would save by being supplied by “free” electricity in return). The scheme can start with a certain percentage of the population, particularly long-time residents and business owners, but including a larger fraction of the population will require some additional thought.

Is there a reasonable timeframe for the payoff for the initial investment?

The UAE has radiation levels that are about double those in Germany, so they can run the installations and receive double the output. If we make certain assumptions about installed costs of 2,000 euros per kilowatt peak, annual outputs of 1,650 kilowatt hours, and ignore any costs of financing, we have a graph plotting feed-in tariffs in fills against the number of years it would require to pay-off. If we are working with about 60 fills, we are working with about six to seven years of return on investment. •

INTERVIEW WITH

Tonjes Cerovsky

SENIOR VICE PRESIDENT SALES – REGION MEA
KSB ME FZE – DUBAI

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Could you provide an overview of KSB's operations in the UAE?

KSB came to the UAE in the early 1970s with an agent selling pumps in Abu Dhabi. We grew quickly through the power and desalination business. Eventually it became necessary to build an after-sales unit; our service workshop Mussafah employs 45 technicians. We also realized a presence in Dubai was important, so we rented a small place on the old side of the free-zone. A year and a half ago we moved into this Jebel Ali facility, which has 40 people. There are sales offices in Abu Dhabi, Qatar and Oman too. In total KSB has roughly hundred people on the ground here, selling, servicing and repairing our equipment. This is still not enough, and this year we will be opening a 4,000 m² service facility in KIZAD. This office covers mainly the Emirates, as well as Oman and Qatar;

and we have agents in Kuwait and Bahrain. Saudi Arabia has its own large KSB entity.

How important is this region to KSB as a global organization?

KSB's strongest region is Europe, which is not growing. The important emerging markets today are in the Middle East, Asia and South America. KSB's Middle East and Africa division, which I manage, expanded by almost 11% last year, even though Libya, Egypt and Syria are in turmoil. Good growth is found here, in Saudi Arabia and Turkey. Abu Dhabi has always been busy, while Dubai is slowly picking up again; Qatar is going down again but Oman is coming back up. Of course, the UAE has just 7 million people, so we cannot compare the size of the market against, say, Russia or Turkey.

You cover a number of industries here. How important is power?

Abu Dhabi, Dubai, Fujairah and the other Emirates could not live without desalination; they simply need combined power and desalination plants.. Power consumption is related to the number of people in a region, so Dubai's fluctuating population (down from two million to 1.4 million, and now back to 1.7 million) affects demand. 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. The power industry is obviously very important here, and we are lucky enough to have a very high market share. In the old Umm Al Nar plant the majority of the pumps are KSB; only the latest stage used one of our competitors; and Taweelah features ours exclusively. You will see fewer KSB pumps in Dubai, because we were not represented there when the plants were being built.

There is a global trend toward efficiency improvements in conventional plants. How can your products help?

Our products can improve efficiency greatly. High consumption in power plants comes in the form of boiler feed pumps with huge motors, which need to be efficient to offset their high costs. ADWEA, in particular, is looking closely at these issues: their employees are well educated, and the consultants they use are almost exclusively European or American. Because they know what they are talking about, it is easy for KSB to convince them of our products' worth. The UAE is a very modern country, always the driver of technological change in the Middle East. Demand for high quality valves and pumps is certainly increasing, especially in the power sector where buyers are well educated on the need for energy efficiency

You have a great solar product portfolio, especially in CSP. Do you expect CSP to be more popular in the region than PV?

CSP is better for us than PV, which does not involve much pumping. 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 to 25 year life cycle of a power plant.

Although it is still running 98% on oil and gas, this country is taking good steps toward renewable energy, which will perhaps contribute 10% in future. It should do more. The sun shines 360 days a year here, and it does so for free. •

INTERVIEW WITH

Kiomars Dabbagh

MANAGING DIRECTOR
SCHOTT MIDDLE EAST

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Could we begin with a brief overview of Schott's operations in the UAE?

Schott has been present in the UAE since 2006. Our goal is to generate sales for the Schott Group across the Middle East region in the power and solar industries. With respect to the regions, we focus on key markets like Saudi Arabia, Oman, Kuwait, and Egypt, excluding the Maghreb. We do not take a country-specific approach, but instead pursue a more regional strategy in order to utilize the synergies that exist within our sales team. The MENA region is of vital importance to Schott's solar thermal technology, by the way, because of the immense potential it offers for innovation.

What solar projects has Schott been involved in so far in the UAE?

I think it is important to point out that the solar business is really only just getting started in the UAE, therefore Schott is prepared to set accents from the very start. We already have a few initial success stories to share, however. For instance, we recently delivered several thousand receivers for a large CSP project in Abu Dhabi and are extremely pleased with how the government has helped to develop a financing model. This has since been joined by several smaller photovoltaic and small off-grid projects, so we have plenty of work to do at the moment.

With regard to the Shams project, there will likely be Shams 2, 3, and 4. What other potential do you see for Schott's solar activities in the UAE?

From our point of view, parabolic trough technology offers the UAE significant advantages due to its long-term proven performance and the fact that it is dispatchable. By that, I mean that this power can be stored and fed into the grid when it is actually needed. Schott Solar

is the market and technology leader when it comes to the receiver tubes that are used in parabolic trough power plants. Our CSP expertise makes us an ideal growth partner for the UAE's solar power industry.

Do you find the solar market very competitive in the UAE?

The CSP market is not necessarily more or less competitive in the UAE than in the rest of the world. Of course, there are regional differences, and there were certainly a few topics that we had to take into consideration in the UAE, for instance insolation or dispersion issues, etc.

You are heavily involved in the Emirates Solar Industry Association. What is the role of this association?

Our main goal is to promote solar as a viable source of energy both today and for the future. Our activities address the key players in the power sector in the UAE, and we clearly serve as a valuable resource for Dubai Supreme Council of Energy (DSCE), Dubai Electricity and Water Authority (DEWA), Abu Dhabi Water and Electricity Authority (ADWEA) and other regulatory bodies. On the other hand, our members come from all over the Middle East and beyond. Therefore, our association clearly reflects the global diversity of its membership and the countries we live in. We strive to bring various players together so that common standards can be set and more networking can go on that benefits the entire solar energy sector.

Solar creates significant media interest although the estimates for power generation in the UAE are still quite modest. Why this dichotomy?

Much of the success in the development of solar energy around the world can be attrib-

uted to the feed-in tariffs and tax incentives we have seen. This is clearly an area in which the UAE still has some catching up to do, for instance by accelerating the introduction of governmental programs and showing greater commitment in general.

Today, however, we are seeing a change in this trend, particularly in the fast growing and energy-hungry economies of Saudi Arabia, Oman and the UAE.

Is the answer to reduce gas power subsidies or implement subsidies on the renewables side?

The vast majority of people in the UAE depend heavily on subsidized electricity, so I would not favor eliminating subsidies, but rather transferring them to solar. Currently, Saudi Arabia and Oman are the most realistic countries in making a strong move towards renewables. Saudi Arabia is well aware of the fact that its oil resources are depleting and that all of the oil produced in the Kingdom will have to be used to generate electricity inside this country by 2050 unless they quickly decide to change their strategy.

Do you see a system of feed-in tariffs for private solar investment working in the UAE?

The European model of feed-in tariffs would be difficult to apply to the UAE for many different reasons, cultural differences, for instance. In Europe, for example, paybacks on investments in the seven to 10 year range are commonly accepted, while people in the Middle East generally reject investments if the payback period takes longer than 24 months. I could easily imagine a more organized, professional private sector being established here in the solar industry, rather than depending on homeowners. •

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INTERVIEW WITH

Goktug Gur & Ahmed Sfar

COUNTRY PRESIDENT - UAE, OMAN & PAKISTAN
INFRASTRUCTURE BUSINESS VICE PRESIDENT
SCHNEIDER ELECTRIC



How important has this region become for Schneider Electric?

Goktug Gur (GG): Schneider Electric has been in the region for more than 30 years. We have acquired Cimac FZCO, a system integrated industrial company, and have manufacturing plants in Pakistan and Sharjah. In the UAE Schneider Electric has an execution center, and we are well represented with sales offices in Oman, Pakistan, Qatar, Kuwait, Bahrain, Abu Dhabi, Dubai and Sharjah. Our total headcount in Gulf & Pakistan amounts to more than 1,200 people representing us in the areas of Lifespace, Buildings, IT, Power, Industry & Infrastructure. Our infrastructure and energy headquarters are in Abu Dhabi, where Schneider Electric's oil and gas competency center is also based. We are targeting increased market share in the region, and our growth expectations are huge.

What are your core products and services for the power sector and how have you felt the development of demand for those services?

Ahmed Sfar (AS): The most dominant business in the UAE is the energy sector, with oil and gas on one side, and utilities and infrastructure on the other. This is an important market for us parallel to our historical residential business market, in which we are also present here. Our strength in oil and gas and utilities comes partly from the acquisitions of companies like GUTOR and Areva Distribution. UAE is a country with a growing economy and population, so demand is rising for our services. We are confident of growth and now we need to position ourselves to make the most of the opportunities.

GG: Services are also an important area for Schneider Electric due to our huge install base. We have a large team, covering services, from system modernization and renovation to maintenance and so on.

Electricity is used very inefficiently in the UAE at the moment. Do you see signs of a strong political will to improve efficiency?

AS: In Dubai, they have no alternative but to push for energy efficiency of consumption; they are buying their electricity, so it is a matter of survival (pls delete). This creates great opportunities for Schneider Electric, which specializes in the area. We want to continue our strategic partnership with Masdar, and expand our 'smart' concept, to make the region more clean and green.

How does the business environment compare between Abu Dhabi and Dubai? Is it in your favor to deal with just one body for all the different processes in Dubai?

AS: Dealing with one body helps, but our main business remains distribution rather than transmission. Whereas Dubai is focusing mainly on increasing efficiency, the focus in Abu Dhabi is still on increasing generation to meet demand growth.

GG: 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.

This office is responsible for business in the northern Emirates and the wider region. What trends are you seeing develop?

GG: We are expecting more investment in tourism, logistics and finance in the northern Emirates, developments that will lead to higher power demand. Turkey has seen good economic trends in the last five years; Saudi Arabia has perhaps done even better. Growth

expectations in Qatar make it a promising market for international companies. Oman is a very stable and solid country, where Schneider Electric would like to increase its presence. Pakistan has huge potential, with its high population and electricity demands; we have 400 people there, and would like to increase this number.

There has been much talk about the impact of fluctuating renewable energy sources on transmission and distribution. What is your view on this?

GG: For Schneider Electric, renewable energy provides an opportunity. Investments in distribution and generation must be synchronized and linked to the existing grid, with a focus on issues like load-shedding. Telvent, which has been acquired by Schneider Electric, has unique smart grid software.

What impact has the acquisition of Areva Distribution had in the UAE? Do you envisage more acquisitions in future?

GG: All of Areva Distribution's installations, like transformers and switchgears, now belong to Schneider Electric. As we did not have high-range transformers, this creates big advantages for us in oil and gas, and energy generation. I cannot comment on any new acquisitions, other than to say what Schneider Electric did in the past is a good predictor of what it will do in future. Any company related to energy management, services or solution provision is of potential interest to Schneider Electric.

Where would you like to see Schneider Electric in the UAE five years from now?

AS: We will do everything to strengthen our power sector position in the next five years, using our own capabilities and those from recently acquired companies. The need is there; and as long as oil and gas is doing well, so will be the funding.

GG: Schneider Electric continues to increase recruitment in the GCC region. It is our aim to hire more local people, who can speak the language and more easily partner with local firms (*pls delete). Big projects are not easy to execute, so we are increasing our back-office engineering competencies; in five years' time, I would like to have merged all our competency centers in the Gulf countries, Saudi Arabia and Turkey. Today we are very strong in installed-base services, but we would like to improve our performance services. •

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Into the Future: Final Thoughts, Company Guide, and Index

"It is a very exciting future, because the UAE has the capital to invest in new capacity, but it currently lacks some of the technology, the human capital and the regulatory framework to achieve this. The UAE is going to be one of the most vibrant and exciting countries in the world. You can see all around you that Dubai in particular is strongly recovering from the global financial crisis, and this is going to be a critical place to invest in future of the power industry."

- Kenneth McKellar,
MIDDLE EAST ENERGY & RESOURCES LEADER,
DELOITTE & TOUCHE (M.E.)



"The great thing about Abu Dhabi is that it understands the needs of the market, and the impact of global events. It does not simply continue to apply one model. You can expect the financing options offered by the authorities to continue to evolve. Abu Dhabi wants to entice international investors by offering conditions that meet their requirements in a difficult world economy."

- Mobin Khan,
Partner and MENA Power & Utilities Market Leader, Ernst & Young

"As advisors we are trying to elevate the understanding and appreciation for the imminence of the issue by creating econometric studies for example – by understanding the power efficiency for the state. Last year Dubai increased their tariffs on residential electricity which although upsetting many residents meant they bought less LNG saving the government hundreds of millions. On the other side of the story is asking if we being responsible in the way we fundamentally use energy, both as companies and as individuals. It is ultimately up to the authorities to encourage this type of positive behaviour through policy, regulation and so on. We are working with the UAE government to build a green growth plan, focusing on how green initiative can be used not just for the environment but for growth, without the presumed sacrifices."

- Mr. Paul Navratil,
Middle East Energy, Utilities & Mining Leader, PwC

"In my view, none of the Gulf countries are likely to charge cost-reflective tariffs in the residential segment for the next decade or two, though higher rates may be introduced for commercial and industrial customers. It is the same with fossil fuels: raising the price to market rates, as economists suggest, could potentially lead to significant social unrest, as it would result in higher prices for many consumer goods and services. I think subsidies for renewables are the answer, as they have been shown to be very effective in countries like Spain. I would also encourage much more R&D in the area of renewables to help bring prices down further to more affordable levels for residential electricity users."

- Robert M. Bryniak,
CEO of Golden Sands Management Consultancy

"Climate change has forced us to look into ways to control the rising temperatures of the planet of which the consequences will be irreversible. Development of renewables is important but not enough, therefore CCS has to be part of the answer. Masdar has recognised the importance of this technology but there is still more work to be done by Masdar, the UAE and globally in improving the technology and lowering the cost. This cannot be done without spending time on R&D but also there is a need for early stage projects on the ground."

- Bader Al Lamki,
Director of Clean Energy at Masdar

"Nuclear power will only contribute 5.6 GWe of the UAE's significant megawatt capacity; it will really fit into the base load scheme. The UAE needs to build more new power plants, and indeed projects are in pipeline. Nuclear energy will contribute to the growth of the UAE will safe and reliable electricity. It will also improve energy security, by diversifying the energy portfolio and will help to achieve better rates of sustainability by saving 12 million tons of greenhouse gas emissions."

- Mohammed Al Hammadi,
CEO, Emirates Nuclear Energy Corporation

"We believe the Middle East has the potential to be one of the most important solar markets in the world. We expect significant company growth to come from the Middle East over the next five years. Projects are coming up in Kuwait, possibly in Oman or Qatar, and in large North African markets such as Egypt and Morocco."

- Christopher Burghardt,
Vice President Business Development EAME, First Solar

"The power needs here are ever increasing, and the UAE has understood that they need to play the green card to remain competitive, so they are looking into renewables and nuclear. A challenge for the region is to build up modern transmission and distribution network with high intelligence and latest state of the art efficiency... The challenges that transmission faces include high temperatures in summer and the high load. People here are also not very conscious of energy usage: they leave the lights on and constantly run air conditioners."

- Hendrik Cosemans,
General Manager, Nynas AB Middle East

"Enpark is developing hand-in-hand with the growth of the UAE's renewable industry. Sustainability – waste reduction, recycling, renewable power and green building technologies – is set to become increasingly important in our daily lives, and we envisage ourselves being a major stakeholder in it. We are currently in talks with government entities over green economic partnerships."

- Saeed Ghubash,
Director, Enpark

COMPANY NAME	WEBSITE	PAGE
Government, Organizations and Associations		
Abu Dhabi Water and Electricity Authority (ADWEA)	www.advec.ae	10, 11, 12, 16, 44, 58, 62, 63, 72, 73
Amcham	www.amchamabudhabi.org	
Australian Business Council Dubai	www.abcduae.com	74
Clean Energy Business Council	www.cleanenergybusinesscouncil.com	48
Dubai Chamber	www.dubaichamber.com	
Dubai Electricity and Water Authority (DEWA)	www.dewa.gov.ae	10,11,12,14, 16, 31, 36, 42, 44, 56, 57, 58, 63, 72, 73, 74
Dubai Silicon Oasis Authority	www.dsoa.ae	
Emirates National Grid	eng.ae	18
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International Renewable Energy Agency (IRENA)	www.irena.org	31, 58, 72, 73
Investment Corporation of Dubai	icd.gov.ae	
Masdar	www.masdar.ae	12, 20, 22, 24, 25, 26, 31, 32, 34, 36, 38, 39, 40, 48, 57, 58, 64, 68
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RAK Investment Authority	www.rak-ia.com	
Regulation and Supervision Bureau	www.rsb.gov.ae	11, 18, 19, 59
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The German Emirate Joint Council for Industry & Commerce (AHK)	www.ahkuae.com	31, 58, 72
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Abu Dhabi National Oil Company (ADNOC)	www.adnoc.ae	
AES Oasis Energy	www.aes.com	
Al Mirfa Power Company	www.ampc.ae	
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Arabian Power Company	www.arabianpower.ae	
Dolphin Energy Limited	www.dolphinenergy.com	
Dusup	www.dusup.ae	
Emirates CMS Power Company	www.taqa.ae	
Fujairah Asia Power Company	www.fapco.ae	
Gulf Total Tractebel Power Company	www.tractebel-engineering-gdfsuez.com	
International Petroleum Investment Company	www.ipic.ae	
Kahrabel GDF SUEZ	www.gdfsuez.com	
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Shuweiha Asia Power Company	www.sapco.ae	
Sumitomo	www.sumitomocorp.co.jp	31
Taweelah Asia Power Company	www.tapco.ae	
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Nuclear, Solar, Wind and Other Renewables		
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Activ Solar	www.activsolar.com	
Apex Power Concepts	www.apexpowerconcepts.com	
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Belectric Middle East	www.belectric.com	
Conergy	www.conergy.com	
CSEM-uae	csem-uae.com	32, 38
EDF	www.edf.fr	28
Emirates Nuclear Energy Corporation	www.enec.gov.ae	12, 19, 28, 31, 45
Emirates Solar Industry Association	www.emiratessolar.com	35, 74
Energy Solutions	www.energysolutions.com	
Enpark	enpark.ae	34, 69
Enviromena Power Systems	www.enviromena.com	
Envitech Middle East	www.envitech.ae	
First Solar	www.firstsolar.com	32, 36, 37, 69
Fortune CP	www.fortunecp.com	
GE	www.ge.com	26
Green Energy	www.greenenergy-uae.com	
Kanne Energies	www.kanne-group.com	
Pentair Technical Products	http://www.pentairtechnicalproducts.com/	
Power One	www.power-one.com	
Ralos Kharafi National Limited	www.ralos-kharafinational.com	
Rensus	www.rensus-uae.com	
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SMA Solar Technology	www.sma.de	
Solar Technology Center	www.solartechologycentre.co.uk	
Sole	www.sole.gr	
Solesa	www.solesa.eu	
Solite Electro Technology	www.solitepower.com	
STV investment	www.stvinvestment.com	
SunEdison	www.sunedisonemea.com	
Sunpower	www.sunpower.ae	
The Change Initiative	www.thechangeinitiative.com	
The Change Initiative	www.thechangeinitiative.com	
Transmission and Distribution		
Abu Dhabi Distribution Company	www.addc.ae	
Abu Dhabi Transmission and Despatch Company	www.transco.ae	16
Al Ain Distribution Company	www.aadc.ae	16
CESI	www.cesi.it	52, 57
Dale Power Solutions	www.dalepowersolutions.com	
Gulf Jyoti International	www.gulfjyoti.com	16, 52, 57
Hager	www.hager.ae	

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Engineering, Construction and Project Management		
ABB	www.abb.com	38
Aecom	www.aecom.com	
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ITOCHU Corporation	www.itochu.co.jp	
Jacobs	www.jacobs.com	
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Mitsubishi Electric	www.mitsubishielectric.ae	
Odebrecht	www.odebrecht.com	
Pacific Controls	www.pacificcontrols.net	
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Schneider Electric	www.schneider-electric.ae	52, 60, 64, 65
Shaw Group	www.shawgrp.com	
SNC Lavalin	www.snclavalin.com	
Sojitz Middle East	www.sojitz.com	
Sterling and Wilson	www.sterlingwilson.ae	
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Yokogawa	www.yokogawa.com	
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Advanced Technology & Power Industries	www.atpiuae.ae	
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Beckhoff	www.beckhoff.ae	
Caltrols Middle East	www.caltrols.com	
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Grundfos	www.grundfos.com	
Kirloskar	www.kirloskar.com	
Klein Tools	www.kleintools.com	
KSB	www.ksb.com	32, 60, 62
Northbridge Middle East	www.northbridge-me.com	
Phoenix Contact	www.phoenixcontact.com	
Power Plus Cable	www.powerpluscable.com	
RAS Power Distribution	www.ras-group.net	
Rittal Middle East	www.rittal-middle-east.com	
Roxtec Middle East	www.roxtec.com	
Safe Line Electrical & Mechanical	www.safelinegc.com	
SES Group	www.ses-uae.com	
SPX	www.spx.com	
Technical Hands	www.technicalhands.com	
Ultimate Power Solution	www.upsgenerator.com	
Union Copper Rod	www.unioncopper.ae	
Victor Industrial & Trading	victoriae.com	
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Dubai Carbon Center of Excellence	www.dcce.ae	
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KPMG	www.kpmg.com	
Manaar Consulting	www.manaarco.com	
PwC	www.pwc.com	12, 60, 68



UNITED ARAB EMIRATES دولة الإمارات العربية المتحدة
NATIONAL BUREAU OF STATISTICS المركز الوطني للإحصاء

جدول 1: إجمالي الكهرباء المولدة حسب الهيئة (2007-2011) (جيجاواط ساعة)

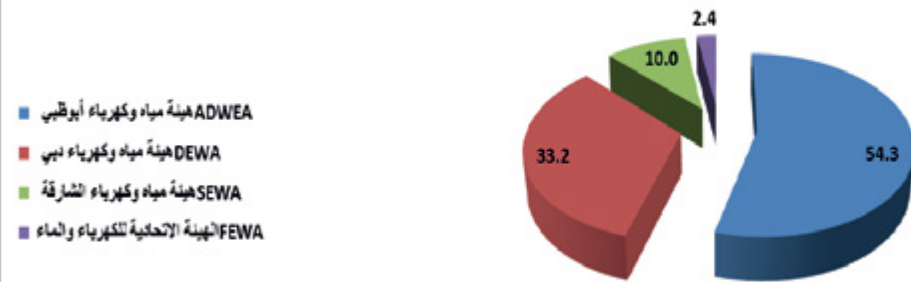
Table 1: Gross Generated Electricity by Authority, 2007-2011 (GWh)

الهيئة	2007	2008	2009	2010	2011	Authority
هيئة مياه وكهرباء أبوظبي	38.592	38.546	43.644	49.942	56.576	Abu Dhabi Water & Electricity Authority (ADWEA)
هيئة كهرباء ومياه دبي	26.030	29.089	31.013	33.742	34.606	Dubai Electricity & Water Authority (DEWA)
هيئة كهرباء ومياه الشارقة	8.968	9.614	9.805	10.254	10.420	Sharjah Electricity & Water Authority (SEWA)
الهيئة الاتحادية للكهرباء والماء ¹	5.171	4.735	3.730	3.401	2.540	Federal Electricity & Water Authority (FEWA) ¹
المجموع	78.761	81.984	88.192	97.339	104.142	Total

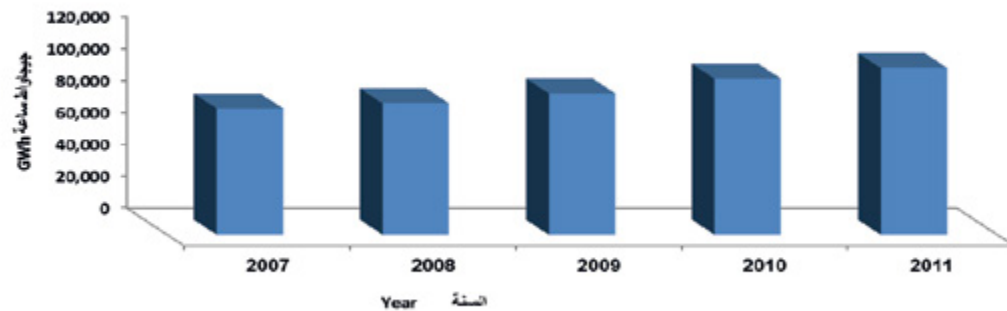
الهيئة الاتحادية للكهرباء والماء: التقدير الإحصائي السنوي للكهرباء والماء
Source: Ministry of Energy: Annual Statistical Report Electricity and Water 2012.

1- Preliminary Data.

شكل 1: التوزيع النسبي للكهرباء المولدة حسب الهيئة 2011
Figure 1: Percentage Distribution of Generated Electricity by Authority, 2011



شكل 2: الكهرباء المولدة 2007-2011
Figure 2: Generated Electricity, 2007-2011



UNITED ARAB EMIRATES دولة الإمارات العربية المتحدة
NATIONAL BUREAU OF STATISTICS المركز الوطني للإحصاء

جدول 2: الكهرباء المستهلكة حسب الهيئة (2007-2011) (جيجاواط ساعة)

Table 2: Consumed Electricity by Authority, 2007-2011 (GWh)

الهيئة	2007	2008	2009	2010	2011	Authority
هيئة مياه وكهرباء أبوظبي ¹	29.342	31.478	34.716	39.173	43.245	Abu Dhabi Water & Electricity Authority (ADWEA) ¹
هيئة مياه وكهرباء دبي	24.756	27.931	30.056	32.551	33.498	Dubai Electricity & Water Authority (DEWA)
هيئة مياه وكهرباء الشارقة	7.682	8.301	8.269	8.644	8.915	Sharjah Electricity & Water Authority (SEWA)
الهيئة الاتحادية للكهرباء والماء ⁴	8.134	10.168	³ 11,363	9.219	² 9,850	Federal Electricity & Water Authority (FEWA) ⁴
المجموع	69.914	77.878	84.404	89.587	95.508	Total

الهيئة الاتحادية للكهرباء والماء: التقدير الإحصائي السنوي للكهرباء والماء
Source: Ministry of Energy: Annual Statistical Report Electricity and Water 2012.

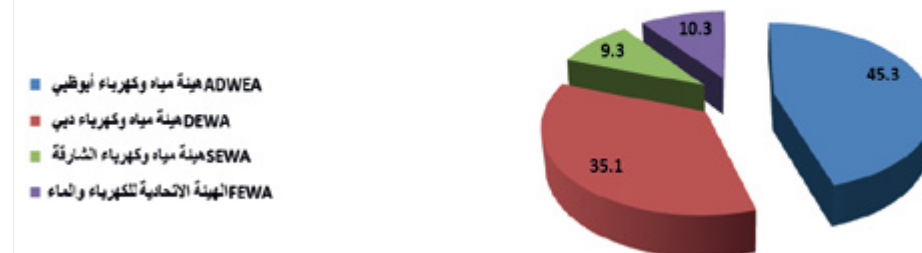
1- Electricity Consumed in Abu Dhabi Emirate .

2- FEWA was Supplied with 7208 GWh from ADWEA.

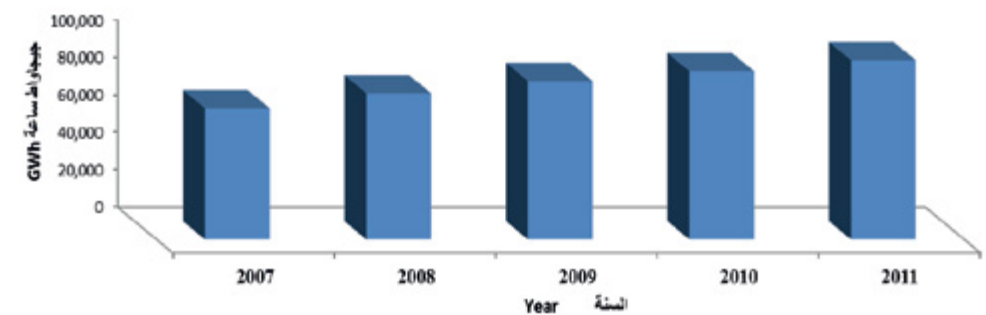
3- Estimated Value.

4- Preliminary Data.

شكل 3: التوزيع النسبي للكهرباء المستهلكة حسب الهيئة 2011
Figure 3: Percentage Distribution of Consumed Electricity By Authority, 2011



شكل 4: الكهرباء المستهلكة 2007-2011
Figure 4: Consumed Electricity, 2007-2011



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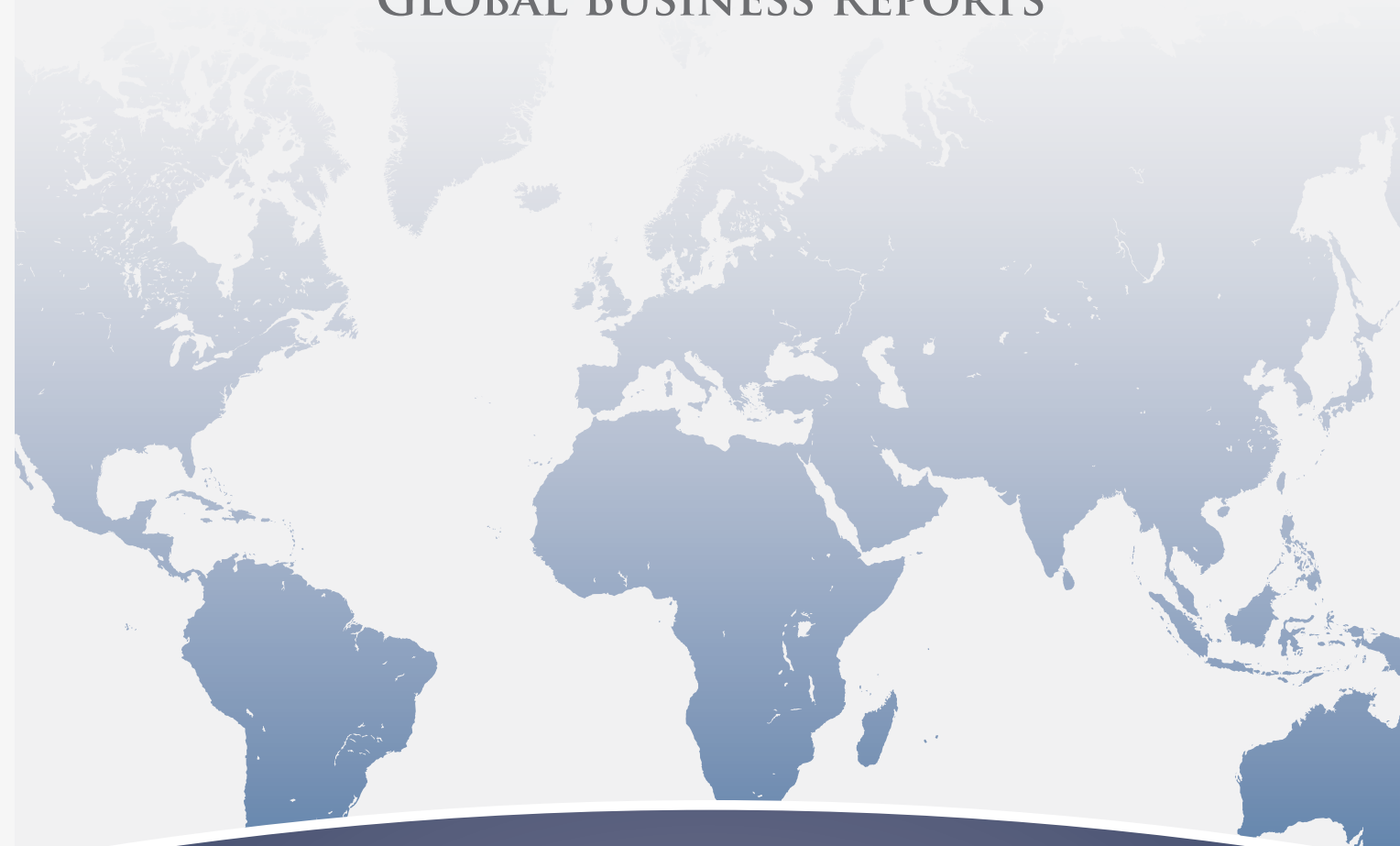
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THANK YOU

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American Business Council Dubai and Northern Emirateswww.abcdubai.com**Australian Business Council Dubai**www.abcduae.com**Dubai Electricity and Water Authority (DEWA)**www.dewa.gov.ae**Emirates Solar Industry Association**www.emiratessolar.com**German Emirati Joint Council for Industry & Commerce (AHK)**vae.ahk.de**International Renewable Energy Agency (IRENA)**www.irena.org**Regulation & Supervision Bureau**www.rsb.gov.ae

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