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REVIEW

EIGHTH EDITION

Editor
David L Schwartz

THE LAWREVIEWS

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PREFACE

In our eighth year of writing and publishing *The Energy Regulation and Markets Review*, we have seen geopolitical changes that have added significant uncertainties to global energy policies. For example, the uncertainties revolving around the United Kingdom's exit from the European Union (a process known as Brexit) have led to uncertainties regarding the UK's energy policies, including with respect to its commitments to reduce greenhouse gases (GHG). The US withdrawal from the multiparty international agreement with Iran this past year and the re-imposition of sanctions have had significant adverse energy investment impacts on Iran and other countries in the region. Despite the withdrawal of the United States from the Paris Agreement and expressions of support from the Trump administration for the coal industry, the United States has continued its extensive investment in renewable generation resources. The 2011 Fukushima nuclear incident continues to impact energy policy in many countries. Finally, we continue to see liberalisation of the energy sector globally.

I CLIMATE CHANGE DEVELOPMENTS

With respect to climate change developments, despite the US withdrawal from the Paris Agreement, we continue to see significant carbon reduction efforts globally, including increases in renewable resources, as well as energy efficiency and demand reduction measures.

In the United States, the Trump administration had pushed for a grid resiliency plan that the Department of Energy (DOE) issued in draft form that, if adopted, would have provided a benefit to the US coal industry, but the Federal Energy Regulatory Commission (FERC) voted unanimously to reject such a plan. A record number of coal and other aged fossil fuel plants retired this past year. Additionally, many states in the United States have pushed for the procurement of thousands of megawatts of renewable resources, including new offshore wind competitive procurements in the north-east. Furthermore, private companies have led the charge to contract for the long-term purchase of renewable energy.

Despite the United Kingdom's continued efforts to follow through on Brexit, this was a record year for renewable generation development and a record low for energy produced by fossil fuel generation. As a result, the United Kingdom experienced a 43 per cent reduction in carbon emissions since 1990. In France, President Macron announced a goal to close the remaining four coal plants by 2022, and France targeted a 40 per cent reduction of GHG by 2030. Italy is seeking to achieve 30 per cent reliance on renewable energy and a 33 per cent reduction of GHG by 2030. Belgium continued its offshore wind procurement efforts, and is seeking to reduce subsidies in future procurements. Denmark is seeking to have all of its energy demand met by renewables by 2050, with 55 per cent reliance upon renewables by 2030. Switzerland is working to increase its reliance upon hydroelectric and other renewable

resources, and to reduce energy consumption by 16 per cent by 2020 and 43 per cent by 2035, compared to 2000 figures. Germany admitted that it would not meet its goal of reducing emissions by 40 per cent by 2020, as well as its goal to reduce energy consumption by 20 per cent since 2008, but it remains focused on renewable generation development, energy efficiency and conservation and energy storage technologies.

Japan continued its efforts to develop solar and wind resources, including opening new sea areas for offshore wind. But the shutdown of most of its nuclear generation has resulted in a significant reliance upon natural gas, including LNG. China set ambitious renewable energy goals, capping energy from coal generation to 5 billion tonnes and aiming to have 15 per cent of generation supplied by non-fossil fuel generation by 2020. Korea planned to abolish its old coal generation facilities by 2022, and committed to cut GHG by 37 per cent by 2030.

Australia began to focus heavily upon energy storage (battery and pumped water) and South Africa increased its renewable independent power procurement efforts.

II INFRASTRUCTURE DEVELOPMENT

For many countries, a reliable energy supply remains the primary concern, regardless of fuel source. As only 35 per cent of Myanmar is connected to the grid, Myanmar continues efforts to electrify remote parts of the country. Iraq continues to have significant infrastructure needs, and Panama and Colombia continue to seek foreign investment. Foreign investment in Iran will be significantly more challenging following the re-imposition of US sanctions.

South Africa is utilising its Integrated Resource Planning process to attract and develop new generation and transmission capacity. Australia is developing one of the largest pumped hydroelectric storage projects globally. Colombia is developing a large hydroelectric project that is expected to produce up to 17 per cent of the country's energy needs, but that effort is hindered by construction delays.

Denmark has five new applications for oil and gas exploration in the North Sea. In the United States, the DOE has issued a study authorising LNG exports to non-FTA nations, finding that the United States will experience net economic benefits from LNG exports, but efforts to develop oil and gas pipelines have been met with increased challenges from environmental groups.

III NUCLEAR POWER GENERATION

Eight years after the Fukushima disaster, Japan has stopped operations for 39 out of its 48 nuclear power stations, and 12 nuclear power stations are in the process of being reviewed for restart under Japan's new stringent safety standards. Germany continues efforts to phase out all nuclear generation, and Belgium's nuclear plants have been offline for maintenance for technical issues for the past few years. France was seeking to eliminate nuclear generation by 2025, but it extended that date to 2035. Korea continued its efforts to phase out nuclear power, abandoning the construction of six new nuclear plants and cancelling the life extension of 10 older nuclear plants. Switzerland shut down one of its remaining nuclear plants.

But the phase-out of nuclear energy is not universal. The United Arab Emirates' new Barakh nuclear power station is 90 per cent complete, and South Africa is still considering building nuclear capacity after 2030. In the United States, even though the early retirement of certain nuclear plants has been driven by cost and power market considerations (rather

than safety concerns), some states have passed legislation to subsidise nuclear energy to allow owners to continue to operate through zero emissions credit programmes, including Illinois, New York and New Jersey, with similar legislation being considered in Pennsylvania and Ohio. While some parties challenged the constitutionality of these zero emissions programmes, two federal courts of appeals have upheld these programmes, and the US Supreme Court denied requests to review those decisions.

IV LIBERALISATION OF THE ENERGY SECTOR

We have seen significant energy sector regulatory reforms in many countries. The European Union has sought to continue efforts to centralise the regulation of the EU energy sector. France has taken significant steps toward further liberalisation of its energy sector, as has Switzerland. Japan fully liberalised its electricity sector, will be implementing unbundling next year, and is liberalising its retail natural gas and petroleum industries to encourage market entry. Australia has opened access to transmission through regulatory reforms to encourage entry into the generation market and has implemented significant market pricing response in response to the increase of renewables. Brazil is implementing net metering regulations this year and is implementing limited retail competition for large load. But the United Kingdom took a step backwards by implementing default price caps rather than market-oriented changes. In the United States, state subsidies for nuclear and renewable generation continue to threaten the effectiveness of capacity market regional pricing.

I would like to thank all the authors for their thoughtful consideration of the myriad interesting, yet challenging, issues that they have identified in their chapters in this eighth edition of *The Energy Regulation and Markets Review*.

David L Schwartz

Latham & Watkins LLP

Washington, DC

May 2019

UNITED ARAB EMIRATES

Masood Afridi and Adite Alope¹

I OVERVIEW

The United Arab Emirates (UAE) is a federation of the seven emirates of Abu Dhabi, Dubai, Sharjah, Ajman, Fujairah, Ras Al Khaimah and Umm al-Quwain. The city of Abu Dhabi in the emirate of Abu Dhabi is the federal capital. Abu Dhabi is the largest emirate by area (making up about 86 per cent of the country's area) and the richest in terms of oil resources. Dubai is the second-largest emirate by size (accounting for about 5 per cent of the country's total area) and the largest by population. Together, Dubai and Abu Dhabi account for about two-thirds of the country's population and form the core of its economy.

The UAE's economy has traditionally been dominated by the petroleum industry but successful efforts at economic diversification have reduced the share of the oil and gas sector in the country's GDP to approximately 36 per cent. The UAE has an open economy with one of the highest per capita incomes in the world and a sizeable annual trade surplus. The currency is freely convertible and funds can be freely repatriated. The country's free zones – offering 100 per cent foreign ownership and zero taxes – are a major conduit for foreign investment in the country. The geographical location of the UAE, situated at the tip of the Arabian Peninsula, makes it a central trading post connecting South-East Asian economies with the Middle East, Africa and Europe. With modern communication and thriving ports, the UAE has emerged as an important trading hub between the Indian sub-continent, Europe, Africa and the Middle East.

The powers of the federal and the emirate governments are enumerated in the State Constitution of 1971. Although the country's government is based on a federal structure, the individual emirates enjoy considerable economic and political autonomy and each emirate largely pursues its own economic policies. Even though Article 120 of the UAE Constitution gives the federal government exclusive legislative and executive jurisdiction over electricity services in the country, in practice the larger emirates of Dubai and Abu Dhabi, to some extent Sharjah, and more recently the northern emirate of Ras Al Khaimah, formulate and implement their own electricity policies. Hence, although there is a Federal Ministry of Energy (which formulates and implements the federal electricity policies), federal legislation on electricity is fairly limited.

Because of the significance of Abu Dhabi and Dubai within the Federation, this chapter focuses primarily on the electricity sector in these two emirates, in addition to the federal laws and policies on electricity.

¹ Masood Afridi is a partner and Adite Alope is a senior associate at Afridi & Angell.

The generation, transmission and distribution of electricity in the UAE is dominated by four water and power authorities. Three of these authorities are owned by the governments of the emirates of Dubai, Abu Dhabi and Sharjah, whereas the authority that operates in the smaller northern emirates is federally controlled. These state-owned authorities serve as the exclusive purchasers and distributors of electricity in the respective emirates. While the private sector has been allowed to participate in the generation of electricity, transmission and distribution is performed exclusively by state-owned authorities.

Abu Dhabi and Dubai currently have the most active private-sector participation in the energy sector. In line with extant regulations, private participants can own up to 40 per cent economic interest in electricity generation plants in Abu Dhabi and up to 49 per cent in Dubai. There has been speculation regarding the introduction of a privatisation policy by the federal government for the northern emirates; however, no formal announcement has been made so far.

Currently, only Dubai, and Abu Dhabi have enacted laws creating specialised regulatory bodies for the electricity sector. These consist of the Dubai Supreme Council of Energy (DSCE), the Dubai Regulation and Supervision Bureau (the RSB Dubai) and the Department of Energy (DOE). The Federal Ministry of Energy and Industry (the Ministry of Energy) regulates the sector at the federal level and works in conjunction with the Federal Electricity and Water Authority (FEWA) to implement the federal government's electricity policy in the northern emirates.

Increasing population growth and urban development has been responsible for electricity demand in the UAE to grow at double-digit rates, and demand is expected to continue to grow at about 10 per cent annually for the next decade because of increasing population growth and industrial development. There is currently insufficient power generation capacity in the northern emirates of the UAE, and demand in these emirates is being met by construction of additional capacity as well as the supply of power from the larger emirates through the Emirates National Grid (ENG). Some industrial projects have not been able to secure sufficient power supply and have had to resort to captive power generation.

A number of major power projects, both in the field of conventional and renewable energy, are under development to meet the country's existing and future electricity needs.

II REGULATION

i The regulators

Federal

The Ministry of Energy, the primary regulator at the federal level, was formed pursuant to Federal Decree No. 3 of 2004 by merging the Ministry of Petroleum and Mineral Resources with the Ministry of Electricity and Water. In 2008, the Ministry of Energy was restructured pursuant to Cabinet Resolution No. 11 of 2008 making it responsible for establishing policies for the water and electricity sectors in the UAE and ensuring that other authorities and companies in the state comply with its policies. A separate directorate for the electricity sector was established within the Ministry of Energy, called the 'Department of Electricity and Desalinated Water'.

In 2014, the federal government further restructured the Ministry of Energy to introduce three new departments:

- a the Clean Energy and Climate Change Department;

- b the Rationalisation and Energy Usage Efficiency Department; and
- c the Regulation and Control Department.

The restructuring was intended to create a more specialised and robust central regulatory authority at the federal level. However, the Ministry of Energy has had little influence in directing policy and implementing projects in the larger emirates of Abu Dhabi and Dubai and remains focused on assisting the smaller emirates in meeting their growing electricity demand.

FEWA, which was established pursuant to Federal Law No. 31 of 1999 (amended by Federal Law No. 9 of 2008) (the FEWA Law), is the dominant player in the northern emirates and engages in all segments of the market, including generation, transmission and distribution. The Ministry of Energy has announced a strategic energy plan to develop the federal government's electricity services by attracting private investment in the sector.

Abu Dhabi

Until recently, Abu Dhabi's electricity sector was regulated under Law No. 2 of 1998 Concerning the Regulation of Water and Electricity Sector, as amended by Law No. 19 of 2007 and Law No. 12 of 2009, by the Abu Dhabi Water and Electricity Authority (ADWEA) (Abu Dhabi Water and Electricity Law). However, in a recent move to reorganise the water and electricity sector, the Emirate enacted Abu Dhabi Law No. 11 of 2018 (the DOE Law) and Abu Dhabi Law No. 20 of 2018 (EWEC Law). Pursuant to these two laws (1) ADWEA and the Regulation and Supervision Bureau for the Water and Electricity Sector (RSB) have been replaced with a newly established Department of Energy (DOE); and (2) Abu Dhabi Water and Electricity Company (ADWEC) has been replaced by the newly formed UAE Water and Electricity Company (EWEC). All the employees, assets, properties, rights and obligations of ADWEA and RSB have been transferred to the DOE, and those of ADWEC to EWEC. However, this does not impact any of the licences and approvals issued by ADWEC (or any of its subsidiaries) prior to the date of issuance of the EWEC Law. In accordance with the Abu Dhabi Water and Electricity Law read with the DOE Law and the EWEC Law (collectively, the Abu Dhabi Electricity Laws), the DOE shall be responsible for, *inter alia*, controlling, supervising and organising the energy sector in Abu Dhabi and for issuing licences to entities engaged in the 'energy sector'.² EWEC will be the sole provider of water and electricity in Abu Dhabi and contract with all entities licensed to produce and distribute water and electricity in Abu Dhabi.

Dubai

Dubai's legislation on the electricity sector was historically limited to Dubai Law No. 1 of 1992 (the DEWA Law), as amended by Decree No. 13 of 1999 and Decree No. 9 of 2011, establishing the Dubai Electricity and Water Authority (DEWA). Dubai has since enacted a

2 'Energy Sector' covers all activities, works and services related to: (1) Production, treatment, storage, transportation, distribution, supply, sale and purchase of gas, oil and derivatives thereof; (2) generation, storage, transportation, distribution, supply, sale and purchase of electricity of all kinds (clean, renewable, traditional); (3) production, treatment, desalination, storage, transportation, distribution, supply, sale and purchase of water; (4) collection, treatment and disposal of sewage and wastewater and the recycling of treated wastewater; and (5) production, storage, distribution and supply of refrigerated liquid for central refrigeration applications.

number of laws to modernise and open the sector to private investment. Two new regulatory bodies have been created: the DSCE,³ established under Dubai Law No. 19 of 2009 (the DSCE Law), as the apex regulator for the energy sector, and RSB Dubai, established pursuant to Dubai Executive Council's Resolution No. 2 of 2010, as the specialist regulatory authority for the electricity sector.

As the primary regulator of the energy sector, the DSCE regulates the exploration, production, storage, transmission and distribution of petroleum products (natural gas, liquid petroleum, petroleum gases, crude oil) and electricity. It ensures that the energy and electricity sources satisfy the current and future demands of the emirate of Dubai at affordable prices. The DSCE also proposes any and all initiatives related to the energy sector, which includes the privatisation of its electricity assets and implementing the provisions of Dubai's Law No. 6 of 2011 Regulating the Participation of the Private Sector in Electricity and Water Production in the Emirate of Dubai (the Dubai Electricity Privatisation Law).

RSB Dubai is authorised to regulate the electricity sector subject to the supervision of the DSCE. RSB Dubai is mainly responsible for regulating, licensing and supervising the electricity generating service providers, facilities and properties. It also determines and establishes standards and controls for electricity generation in the emirate and proposes legislation governing the electricity sector in Dubai.

As with the other emirates, the main player in the electricity market is DEWA, Dubai's state-owned integrated power generation, transmission and distribution authority.

Sharjah

Sharjah created its own electricity authority in 1995, known as the Sharjah Electricity and Water Authority (SEWA). SEWA, established pursuant to Sharjah Emiri Decree No. 1 of 1995, as amended by Emiri Decrees No. 2 of 2000, No. 46 of 2006 and No. 20 of 2008, is authorised to 'own, manage, operate and maintain' power stations and electricity transmission lines. As with the other emirates, SEWA is responsible for the generation, transmission and distribution of electricity in Sharjah. SEWA is authorised to determine electricity prices and connection fees, which are subject to approval by the Ruler of Sharjah.

Northern emirates

FEWA is responsible for the generation, transmission and distribution of electricity in the northern emirates of Ajman, Ras Al Khaimah, Fujairah and Umm al-Quwain.

Ras Al Khaimah

On 10 March 2013, the Ruler of Ras Al Khaimah issued an Emiri Decree No. 4 of 2013 on the Establishment of the Ras Al Khaimah Electricity and Water Authority (RAKEWA) (the RAKEWA Law). This authority is tasked with the regulation, management, operation and maintenance of power stations, water desalination plants, electricity distribution and transport networks in the emirate. The new authority is also responsible for controlling prices of electricity and water in the emirate. Most importantly, the authority is responsible

3 Member organisations of the DSCE are DEWA, Dubai Aluminium Company Ltd, Emirates National Oil Company, Dubai Supply Authority, Dubai Petroleum Establishment, Dubai Nuclear Energy Committee, Dubai Municipality, Department of Petroleum Affairs and the Road and Transport Authority.

for fulfilling the electricity needs of the emirate, planning for the generation, transport and distribution of electricity in the emirate and managing the government's investments in the sector.

RAKEWA is to be managed by a board appointed by the Ruler of Ras Al Khaimah, to be headed by a chairman. The board is authorised to issue regulations relating to the electricity sector, which shall be binding on all entities involved in the electricity and water sectors in the emirate.

Despite the establishment of RAKEWA, FEWA continues to own, manage and operate the electricity resources situated in the emirate and is the *de facto* authority on ground. The RAKEWA Law does not contain any provisions for the transfer of assets from FEWA to RAKEWA and it is presently unclear whether RAKEWA will replace FEWA in Ras Al Khaimah or if the two authorities will operate jointly in the emirate.

ii Regulated activities

All activities connected to the generation, transmission and distribution of electricity in the UAE are regulated and require specific licences from the relevant regulatory authorities.

Under the Abu Dhabi Electricity Laws, regulated activities pertaining to the energy sector include electricity generation, transmission, distribution and supply to premises. Any person or entity intending to carry out these activities is required to be licensed by the DOE.

Under the Dubai Electricity Privatisation Law, regulated activities include 'any activity related to generating electricity . . . for the purpose of supplying to the Transmission System with produced electricity' (the transmission system is owned and operated by DEWA). All activities relating to electricity generation, transmission, distribution and supply of electricity are considered regulated activities in Dubai and require a licence from RSB Dubai.

iii Ownership and market access restrictions

As indicated earlier, Abu Dhabi has allowed private sector participation of up to 40 per cent in its power generation sector. In furtherance of its legislative policies in this regard, in 2015 Dubai awarded 49 per cent of the ownership of phase 1 of Hassyan, a 2,400MW clean coal power plant, to a consortium led by Harbin Electric International and ACWA Power (Hassyan Clean Coal Project). At the federal level, while FEWA has since recently been inviting bids from private entities, private sector participation has yet to gather speed in the northern emirates. UTICO (a private sector utility company engaged in electricity generation, transmission and distribution) in Ras Al Khaimah and Emirates Sembcorp Water & Power Co – ESC (a joint venture between ADWEA and a private sector entity, operating a hybrid desalination and power plant by the name of Fujairah F1 Independent Water and Power Plant) in Fujairah are a few examples of private sector partnerships in the northern emirates.

Under Federal Law No. 2 of 2015 on Commercial Companies (the Companies Law),⁴ foreigners are permitted to own up to a maximum of 49 per cent of a UAE company (other than in the free zones) and the majority 51 per cent is required to be owned by UAE nationals. The power sector is no exception to this requirement. While Federal Law No. 19 of 2018

⁴ Federal Law No. 2 of 2015 on Commercial Companies abrogated Federal Law No. 8 of 1984 (as amended).

on Foreign Direct Investment (the FDI Law) was recently promulgated⁵ to allow 100 per cent foreign ownership of companies in certain sectors in the UAE subject to approval of the UAE Cabinet, the FDI Law sets out a 'Negative List' of 13 sectors where existing laws and restrictions will continue to apply and majority foreign ownership will not be permitted. This includes water and electricity services.

Although this restriction is a deterrent to foreign investment, it is not an insurmountable hurdle as informal arrangements exist to enable the foreigner investors to transfer 100 per cent beneficial interest in local companies to themselves. It is common for foreign investors to enter into side agreements with the local majority-owning partners by virtue of which the foreign shareholders assume management powers and at the same time transfer to themselves the economic interest in the shares held by the local. The local shareholder is usually paid a fixed fee as part of this arrangement for acting as a local sponsor. The authorities in the UAE have so far tolerated this practice, and as long as there is no dispute between the parties, the arrangement works to the benefit of all shareholders. The enforceability of these side agreements is questionable and untested in the local courts. Although the local partner could, in theory, take over the business by revoking the side agreements, the arrangement works well in the vast majority of cases and offers a practical way forward for foreign investors wishing to do business in the UAE.

Although the UAE free zones allow for 100 per cent foreign ownership, the free zone companies are not allowed to conduct business outside the free zones and within onshore UAE. To date, there are no power generation, transmission or distribution companies in any of the free zones in the UAE. Electricity rates are subsidised throughout the UAE and it is therefore not viable for private producers to construct power plants within the free zones. Furthermore, the state-owned authorities in the emirates of Dubai and Abu Dhabi have sufficient capacity to meet present and anticipated future needs, and this has therefore not necessitated private investment in the sector in the free zones.

The UAE's electricity laws themselves do not impose any specific ownership restriction on foreign investors in the UAE, nor do they necessarily require government participation in the sector. As a matter of policy, in Abu Dhabi, although two or more foreign joint venture partners are permitted to own up to 40 per cent of a project company, the RSB (historically) and now the DOE, ensures that a foreign entity does not own more than 25 per cent of the market by capacity.

Most power companies in the UAE (with some exceptions such as UTICO) are either wholly or majority owned by the federal or respective emirates' governments, and the sector is dominated by the state-owned water and electricity authorities. Of these, DEWA and DOE (formerly ADWEA) being the largest two, account for about 95.4 per cent of the UAE's gross generated electricity. As of the figures available for 2016, ADWEA (now the DOE) accounts for approximately 62.1 per cent of the UAE's gross generated electricity (at 80,527GWh), DEWA for 33.3 per cent (at 43,092GWh), Sharjah Electricity and Water Authority (SEWA) for 4.4 per cent (at 5,684GWh) and FEWA for about 0.2 per cent (at 293GWh).

5 Issued on 23 September 2018.

Abu Dhabi

The DOE was established pursuant to the DOE Law, and is responsible for all matters relating to formulation, development and implementation of policies for the electricity sector in Abu Dhabi, including privatisation. As mentioned previously, the DOE has replaced ADWEA and RSB and has inherited all of their assets, properties, rights and obligations.

To date, a number of independent water and power producers (IWPPs) have been established as joint-venture arrangements between ADWEA and various international power companies as BOO (build, operate, own) projects, which include:

- a* Arabian Power Company;
- b* Emirates CMS Power Company;
- c* Emirates SembCorp Water and Power Company;
- d* Fujairah Asia Power Company;
- e* Gulf Total Tractebel Power Company;
- f* Ruwais Power Company;⁶
- g* Shuweihat Asia Power Company PJSC;⁷
- h* Shuweihat CMS International Power Company;
- i* Taweelah Asia Power Company; and
- j* Mirfa International Power and Water Company.

The ownership of the above-mentioned IWPPs is split 60:40 between ADWEA (or its subsidiaries) and the foreign investor. The project companies are usually structured as joint stock companies incorporated in Abu Dhabi. The most common ownership structure is one in which ADWEA (and henceforth the DOE) incorporates an intermediate holding company to own a 60 per cent stake, which is in turn held 10 per cent by ADWEA (and henceforth the DOE) and 90 per cent by the Abu Dhabi National Energy Company PJSC (also known as TAQA).⁸ A few project companies have other ownership structures.

In early 2018 ADWEA had invited private-sector entities to submit expressions of interest to participate in a US\$1.2 billion water desalination plant in Abu Dhabi (the Taweelah Desalination Plant). ACWA Power won the bid for the Taweelah Desalination Plant and has signed a power purchase agreement with EWEC. The construction of the project will commence in May 2019 with completion expected in October 2022. The project is held 60 per cent by the DOE and 40 per cent by ACWA Power.

6 The Shuweihat S2 IWPP, owned by Ruwais Power Company was commissioned in October 2011, adding a further 1,507MW to Abu Dhabi's power generation capacity and 100 million imperial gallons of potable water each day.

7 In February 2011, a PPA for the Shuweihat 3 power plant was signed between ADWEC (now EWEC) and Shuweihat Asia Power Investment BV, a company 60 per cent-owned by ADWEA (now the DOE) and 40 per cent by Sumitomo Corporation of Japan and Korea Electric Company (each holding 20.4 per cent and 19.6 per cent respectively). This plant has been operational since September 2014 and generates 1,600MW.

8 Jeffery Delmon and Victoria Rigby Delmon, *International Project Finance and PPPs: A Legal Guide to Key Growth Markets 2012*, Chapter 16, p. 26 (2012). TAQA, in which the DOE (formerly ADWEA) owns a 74.05 per cent ownership stake, was established under Abu Dhabi Decree No. 16 of 2005 and serves as ADWEA's (now the DOE's) investment arm in the emirate and abroad. Other Abu Dhabi government entities own a further 1.16 per cent of TAQA with the total government shareholding being 75.21 per cent. The remaining 24.79 per cent of TAQA is owned privately.

Dubai

DEWA was established as an independent public authority owned by the government of Dubai, responsible for the development and provision of utilities in the emirate. DEWA is managed by a board of directors whose members are appointed by Emiri decree.

DEWA is an integrated supplier owning and operating in all segments of the electricity market in Dubai. DEWA owns and operates 12 plants in the emirate whose individual capacities vary between 400MW to 2,200MW, with a total installed capacity of 10,413MW of June 2018.⁹ Although the Dubai government wants to promote private investment in its electricity generation sector, to date, all of the power generation capacity of Dubai, except for captive power produced by certain entities (e.g., Dubai Aluminium Company Ltd), is owned by DEWA.

In 2011 Dubai passed the Dubai Electricity Privatisation Law, which is broadly modelled on the Abu Dhabi Water and Electricity Law. The Dubai Electricity Privatisation Law authorises DEWA to establish project companies, by itself or in collaboration with third parties, for the generation of electricity. In 2015, Dubai Law No. 22 of 2015 on Regulating Partnership between Public and Private Sectors in Dubai (the Dubai PPP Law) was enacted, which governs the regulatory framework of public–private partnerships in Dubai. The Dubai PPP Law aims to encourage private-sector participation in the development of projects. It sets out, *inter alia*, the terms of partnerships between the public and private sector and conditions for approval of prospective projects.

To date, several independent power projects (IPPs) have been launched in Dubai. The first IPP is Al Hassyan 1 IPP, a 1,500MW gas-fired power plant, for which bids were solicited in December 2011. The project has, however, been deferred indefinitely.

In 2015, a consortium of ACWA Power and TSK Electronica y Electricidad SA won the bid to set up a 200MW photovoltaic plant (Shuaa Solar PV Project) in the second phase of the Mohammed bin Rashid Al Maktoum Solar Park¹⁰ (Solar Park) on the IPP model. The project has been operational since April 2017.

Subsequently, the Hassyan Clean Coal Project was launched by DEWA and the consortium of ACWA Power and Harbin Electric was awarded the project.¹¹ In 2016, the major engineering procurement and construction contract for the Hassyan Clean Energy Project was awarded to Harbin Electric International and General Electric. The project is proposed to be operational by 2023.

Another development in 2016 was the selection of the consortium led by the Abu Dhabi Future Energy Company (Masdar), including the Spanish companies FRV (Fotowatio Renewable Ventures) and Gransolar Group for construction of the 800MW third phase of the Solar Park on the IPP model. The first phase of the project (200MW) is expected to be operational in the first half of 2018, followed by the second phase (300MW) in 2019, and the third phase (300MW) in the first half of 2020.

9 <https://www.dewa.gov.ae/en/about-dewa/news-and-media/press-and-news/latest-news/2018/06/dewa-commissions-15132-11-kv-substations-in-2018>.

10 The special purpose vehicle set up to establish the project is Company Shuaa Energy 1, in which DEWA is a 51 per cent stakeholder and the remaining 49 per cent is held by the consortium of ACWA Power and TSK.

11 The special purpose vehicle set up to establish the project is Hassyan Energy Phase 1 PSC, in which DEWA is a 51 per cent stakeholder and the remaining 49 per cent is held by the consortium of ACWA Power and Harbin.

As the fourth phase of the Solar Park, DEWA released an expression of interest in October 2016 to build the largest concentrated solar power project in the world of 700MW (CSP), based on the IPP model. The project has been awarded to ACWA Power and Shanghai Electric and is proposed to be commissioned in stages, starting from the fourth quarter of 2020. In March 2019, DEWA also issued a request for qualification for the 900MW fifth phase of the Solar Park, proposed to be commissioned in stages commencing in the second quarter of 2021.

In addition to the above, Mohd Abdulla Haji Yousuf Khoory & Co LLC (trading as Union Paper Mills) was granted an electricity generation licence in November, 2016 in relation to a 3MW biomass boilers' facility at Al Quoz, Dubai.

In March 2017, Al Ghurair Resources Oils & Proteins LLC was granted a licence by RSB Dubai to generate electricity from an up to 8MW coal plant in Jebel Ali.

DEWA is also developing a 250MW power station, which will use water stored in the Hatta Dam, which can total up to 1.7 billion gallons. The project is the first of its kind in the Arabian Gulf, with a lifespan of 60 to 80 years. There is limited information in the public domain regarding any tenders issued by DEWA to award the project to a private sector participant.

Sharjah

SEWA acts as the single point of sale for all power generated in Sharjah. In January 2019, GE and Sumitomo Corporation signed a 25-year power purchase agreement with SEWA to develop, build and operate a 1.8GW combined cycle power plant located in Hamriyah, Sharjah.

Northern emirates

FEWA is authorised under the FEWA Law to establish private power generation plants in the northern emirates. A number of projects are presently under development in these emirates but these are primarily owned in the public sector.

FEWA acts as the single point of sale for all power generated in the northern emirates. Electricity transmission and distribution networks within the northern emirates are also primarily owned and operated by FEWA. However, recently, TRANSCO has expanded its operations to assist FEWA in planning, developing and operating its water and electricity transmission assets in the northern emirates. In addition to FEWA, certain private power companies such as UTICO are involved in the generation, transmission and distribution of power in the emirate of Ras Al Khaimah.

In September 2017, FEWA invited expressions of interest from potential developers for the development of a 1.8GW coal-fired power plant in Umm al-Quwain or Ras Al Khaimah on the PPP model. The project has not yet been awarded to any bidder.

In December 2018, the government of Umm Al Quwain signed a cooperation agreement with FEWA for the construction of a 200MW solar power plant in Falaj Al Mualla, Umm Al Quwain. There is limited information in the public domain regarding any tenders issued to award the project to a private sector participant.

iv Transfers of control and assignments

Any transfer of control or assignment of an interest in an IWPP requires the consent of the relevant regulator.

Under the Abu Dhabi Electricity Laws, a licence may not be transferred unless it specifically permits its transfer. Prior consent of the DOE is required for any transfer (including the creation of security over assets of the licence holder), and the consent may be subject to such conditions as the DOE may consider appropriate.

Under the Dubai Electricity Privatisation Law, licensed entities are not permitted to transfer or assign their licences without the prior approval of RSB Dubai. In addition, licensed entities may not dispose-off, sell, lease or otherwise transfer, including granting of a security interest over, their 'main assets' without prior approval from RSB Dubai. Main assets are those movable and immovable assets necessary to conduct the regulated activities and operate the electricity generation facilities.

In addition, the Companies Law contains a statutory pre-emptive right in favour of existing shareholders in the case of limited liability companies and joint stock companies.

III TRANSMISSION/TRANSPORTATION AND DISTRIBUTION SERVICES

i Vertical integration and unbundling

The electricity transmission and distribution networks in the UAE are firmly owned and controlled by the state-owned water and power authorities, each of which enjoys a monopoly in its particular area of operation. These authorities are vertically integrated and operate in all three segments of the market.

Abu Dhabi

TRANSCO operates Abu Dhabi's transmission networks. Until implementation of the DOE Law, TRANSCO was wholly owned by ADWEA. TRANSCO supplies electricity from the generation companies to the two distribution companies of Abu Dhabi, each of which was previously wholly owned by ADWEA, and now by the DOE. These are:

- a* Abu Dhabi Distribution Company (ADDC), which operates in the city of Abu Dhabi and the western region of the emirate; and
- b* Al Ain Distribution Company (AADC), which operates in Al Ain city and the surrounding areas.

In response to the power shortages faced in the northern emirates, TRANSCO has become involved in the planning, development and operation of electricity transmission networks in the northern region. TRANSCO's involvement, given its resources and experience, coupled with ADEWA's supply of its excess power, has largely alleviated the power problems faced by these emirates in the past.

Dubai

DEWA is the sole purchaser of electricity in Dubai and presently owns all the generation, transmission and distribution capacity of the emirate.¹² DEWA's transmission and distribution network is constantly being expanded as new real estate and industrial projects are set up across Dubai.

Over the past few years, DEWA has further enhanced the electricity transmission networks of the emirate. This includes construction of substations at Jebel Ali (December 2012), the International Media Production zone (February 2013), the Dubai Marina (May 2013), Seih Al Dahl (February 2014) and Dubai Academic City (2016). As of 2016, DEWA had 21 400kV substations, 222 132kV substations, 111 33kV substations and 31,961 11kV and 6.6kV substations. In February 2017, DEWA announced its plans to build 97 new 132/11kV substations over the next three years to be located at the Solar Park, and other locations to support the expansion of other power plants in Jebel Ali and Al Aweer. This was followed by an announcement by DEWA in April 2017 of its plans to build three new 400kV substations over the next three years. DEWA is also currently building three new 132/11kV substations with 45 kilometres of high voltage (132kV) cables for the World Expo 2020. The substations are named Sustainability, Mobility and Opportunity after the three subthemes of the Expo. The first of these substations (named Mobility) was commissioned in January 2018. As of 20 May 2018, fifteen 132/11 kV substations have also been commissioned in Salal, Saih Al Shuaib, Expo 2020, Warsan 1, Sheikh Mohammed bin Rashid Gardens, Palm Jumeirah, Al Markad, Nad Al Hammar, Business Bay and Zabeel 2.

Sharjah

SEWA is the sole purchaser of electricity in Sharjah and presently owns all the generation, transmission and distribution capacity of the emirate.

Because of the increased demands in electricity and energy, SEWA has recently embarked on improving and expanding its electricity transmission and distribution network on a large scale. SEWA has commissioned and inaugurated the Al Khan power transmission and distribution station (worth 105 million dirhams) in 2016, to ensure the reliability of power supply throughout areas such as Al Khan, Al Nahda and Al Taawun in Sharjah and has announced its plans of building three 132kv and five 33kv distribution stations in 2017.

Northern emirates

FEWA performs many of the same functions in the northern emirates with respect to electricity distribution and transmission as TRANSCO in Abu Dhabi and DEWA in Dubai.

The northern emirates have been suffering insufficient power and electricity generation. For this reason and because of increased demand for electricity, FEWA has announced a number of new projects to expand and improve its electricity network. The notable projects are as follows:

- a in May 2013, FEWA signed two contracts with the Saudi National Contracting Company Limited to commission a 33/11kV transmission station and upgrade a

12 As of 2016, DEWA operates a network of overhead lines (1,125 kilometres of 400kV, 413 kilometres of 132kV and 113 kilometres of 33kV lines) and underground cables (23 kilometres of 400kV, 1,800 of 132kV, 2,052 kilometres of 33kV and 29,384 kilometres of 6.6 and 11kV lines) that are, in turn, connected to a distribution system of lower voltage substations and distribution lines.

number of 33/11kV and 132/33/11kV stations in the western region (Ajman and Umm Al Quwain), the central and eastern region (Fujairah and Dibba) and the northern region (Ras Al Khaimah);

- b* in 2016, FEWA inaugurated Al Hamra substation in Umm al-Quwain and plans future expansion of the same. In the same year, FEWA signed a memorandum of understanding with Siemens for the construction of a 2.2GW plant in the northern emirates to enhance electricity generation and distribution and another memorandum of understanding with Mitsubishi Electric for the installation of a number of 132/33/11KV substations in the northern emirates;
- c* in October 2017, FEWA invited bids from the private sector for the construction of a 132/33/11kV substation and cable works to be positioned in the northern emirates; and
- d* in August 2018, FEWA announced that it will build six new sub stations in the new residential areas of Ras Al Khaimah by 2020.

Emirates National Grid

The ENG project was launched in 2001 under a Cabinet Resolution No. 79/4 of 2001 'On the National Project of Linking the Power Grids' to connect and enable sharing of power between the UAE's seven emirates. The ENG project was launched by the Ministry of Energy with the purpose of enhancing integration between the various electricity and water authorities in the UAE, each of which contributed proportionately to the capital investment required to build the ENG. The ENG is owned by the following authorities in the proportions stated below:

- a* DOE (formerly ADWEA): 40 per cent;
- b* DEWA: 30 per cent;
- c* FEWA: 20 per cent; and
- d* SEWA: 10 per cent.

Dubai and Abu Dhabi's power grids were connected by the ENG in the middle of 2006, whereas SEWA's connection to ENG was completed in May 2007. Connection to the remaining northern emirates transmission networks was completed in April 2008.

On account of its larger production capacity and extensive distribution network, ADWEA (now the DOE) has increasingly been assisting the other emirates in meeting their power demand. ADWEA exported about 13,664GWh of electricity to other emirates via the ENG in 2012, up from 12,228GWh in 2011. Renewable energy sources such as solar and nuclear power will increasingly contribute to the ENG. Currently, the solar power is transmitted to the ENG from Shams 1 solar power plant and plans are under way for nuclear energy and further solar power to be transmitted from the Barakah nuclear energy power plant and photovoltaic panels respectively.

The Gulf Cooperation Council (GCC) Grid

The UAE is also connected to the rest of the GCC through the GCC Grid, through which it can trade electricity with the remaining GCC countries. About 56MW (peak time) of electricity was exported by Abu Dhabi to the GCC Grid in 2011 whereas 7MW (peak time) was imported in 2012. Ideas have been put forward to expand power grids to Egypt and European networks (through Turkey) and trade energy beyond the GCC region.

ii Transmission/transportation and distribution access

Abu Dhabi

The Abu Dhabi Electricity Laws require EWEC to purchase all power produced within the emirate. Although the Abu Dhabi Electricity Laws contemplate private ownership in all segments of the electricity supply chain, so far private ownership has been limited to generation only.

Dubai

The Dubai Electricity Privatisation Law prohibits a licensed entity from selling electricity to any entity other than DEWA.

iii Rates

Abu Dhabi

EWEC (formerly ADWEC), being the single buyer of electricity in the emirate of Abu Dhabi, purchases electricity from the power producers under long-term power and water purchase agreements (PWPAs) and sells it to the distribution companies via annual bulk supply tariff (BST) agreements. The distribution companies pay EWEC the BST for the electricity purchased and receive revenue from their customers and a subsidy from the government. TRANSCO is paid a transmission use of system (TUoS) charge by the distribution companies.

The components making up the electricity tariff in Abu Dhabi are the following:

- a* BST, which is the charge paid by the distribution companies to EWEC for its generation costs (in turn paid by EWEC to power producers).
- b* TUoS, which is the charge paid by the distribution companies to TRANSCO for use of its transmission network.
- c* Distribution use of system, which is the fee that the distribution companies charge for use of their distribution network.
- d* Sales cost, or the cost incurred by the distribution companies for serving customers for meter reading and billing.
- e* Government subsidy, consisting of direct payments from the government to the distribution companies. The quantum of the subsidy allows the government to determine the electricity tariffs for different classes of consumers. The higher the subsidy, the lower the tariff charged.

The electricity tariff is determined by adding components (a) to (d) and subtracting (e).

The rates charged by the state-owned power companies (EWEC, TRANSCO, ADDC and AADC) are subject to government control, exercised via the DOE. The DOE sets their revenue target on the basis of which the control prices are determined. The remainder of the revenue is paid as a subsidy by the government to the distribution companies. All transactions between the power sector companies and any related tariffs are required to take place on the basis of their economic costs. This helps the government keep subsidies to a minimum.

The BST is calculated for each calendar year on the basis of parameters prescribed by the DOE. The calculation of BST requires the estimation of the costs for procuring and dispatching electricity generation to meet the forecasted demand. Starting in 2012,

the structure of the BST comprises three components (expressed in fils per kWh) charged on an hourly basis for electricity purchased at different times of the day, for 'Fridays' and 'non-Fridays' and in different months of the calendar year. These three components are:

- a* a system marginal price charge estimated to indicate the short-term marginal costs (excluding backup fuel (BUF) costs) of providing units at different times of the day;
- b* a BUF levy charge estimated to reflect the additional costs associated with the burning of backup fuel rather than primary fuel; and
- c* a high-peak period charge assessed to cover the costs associated with the estimated capacity payments and charged only in the peak demand occurring months of June to September, inclusive.

The TUoS charge paid to TRANSCO covers the investment, operation and maintenance costs of the infrastructure of the transmission systems, excluding assets that are dedicated entirely to a particular customer. These include substations, overhead lines, cables and associated equipment. TUoS charges also cover the costs of the economic scheduling and dispatching of electricity generation.

The rates payable to the power generation companies are determined on the basis of the PWPAs entered by them with ADWEC (and going forward, EWEC). These PWPAs are further discussed below.

Contracts for power generation are awarded based on a competitive bidding process after the government invites tenders to meet the emirate's power generation requirements. The bidding process is managed by the DOE starting from pre-qualification of bidders and issuance of request for proposals through to selection of the successful bidder.

Electricity rates paid by consumers in Abu Dhabi are subsidised. In fact, UAE nationals benefit from even greater subsidies than those given to expatriate workers. The rates payable in Abu Dhabi were substantially revised in 2015 with the introduction of a slab tariff scheme and an increase of 40–60 per cent in the applicable rates. The rates as published on the ADDC website for 2018 are divided according to consumer categories as follows:

- a* UAE nationals (flats): 6.7 fils per kWh until 30kWh/day, 7.5 fils post 30kWh/day;
- b* UAE nationals (villas): 6.7 fils per kWh until 400kWh/day, 7.5 fils post 400kWh/day;
- c* non-UAE nationals (flats): 26.8 fils per kWh until 20kWh/day, 30.5 fils post 20kWh/day;
- d* non-UAE nationals (villas): 26.8 fils per kWh until 200kWh/day, 30.5 fils post 200kWh/day;
- e* industrial establishments (below 1MW): 28.6 fils per kWh;
- f* industrial establishments (above 1MW): 27.0 fils per kWh at off peak hours, 36.6 fils per kWh at peak hours;
- g* commercial establishments: 20 fils per kWh;
- h* governmental offices: 29.4 fils per kWh; and
- i* farms and ranches: 4.5 fils per kWh.

The rates for 2019 have not yet been published. With effect from 1 January 2018, VAT at the rate of 5 per cent has been implemented in the UAE pursuant to Federal Law No. 8 of 2017 (the VAT Law). Under the VAT Law, the 5 per cent VAT is payable by consumers on their electricity and water consumption. However, VAT is not applicable in respect of the municipality fee levied by the power companies in the respective emirates.

Dubai

The DEWA Law empowers the board of directors of DEWA to control electricity prices charged by DEWA, subject to the Ruler's approval; however, since the promulgation of the DSCE Law, the electricity prices have been determined by the DSCE and DEWA now sets its prices in accordance with the DSCE's directives. The DSCE Law empowers the DSCE to impose a 'definite tariff based on cost when necessary'. The DSCE is also authorised to approve fees and tariffs on the services offered to the public by 'energy service providers' (meaning the power generation, transmission and distribution companies).

In 2011, Dubai passed Executive Council Decision No. 16 of 2011 on the Approval of the Electricity and Water Tariff in the emirate of Dubai (the Dubai Tariff Decision), which sets out the electricity and water tariffs for Dubai. The Dubai Tariff Decision provides for a slab tariff scheme and authorises DEWA to add the 'fuel price difference' to the electricity tariffs charged to consumers. The consumers are divided into (1) industrial (2) residential and (3) commercial. UAE nationals are subject to tariff rates equal to roughly one-third of the rate applied to other residential consumers.

DEWA has since 2011 increased electricity rates and pursuant to the Dubai Tariff Decision, introduced a variable fuel surcharge in its electricity tariff. The electricity tariff in Dubai now comprises the electricity consumption charges, the fuel surcharge and meter charge. The fuel surcharge component requires consumers to pay for any fuel cost increases using 2010 fuel prices as the benchmark, thereby passing on the risk of international fuel price fluctuations to the consumer. This has enabled the company to increase revenues, reduce demand growth and earn higher profits. The present fuel surcharge rate applicable in the emirate of Dubai is 6.5 fils/kWh. Since the introduction of the VAT Law, 5 per cent VAT is payable on the consumption of electricity and water in Dubai. As mentioned previously, VAT is not applicable in respect of the housing fee, sewerage fee and irrigation fee that DEWA collects on behalf of the Dubai municipality. Knowledge fee and innovation fee are also exempted from VAT.¹³

IV ENERGY MARKETS

i Development of energy markets

The electricity market for private power producers in the UAE is comprised of the state-owned water and power authorities each of which acts as the single point of sale in their respective areas of operation.

Contracts for power generation are awarded on the basis of a competitive bidding process, administered by the DOE in Abu Dhabi, DEWA in Dubai, SEWA in Sharjah and FEWA in the northern emirates.

ii Energy market rules and regulation

Under the Abu Dhabi Electricity Laws, EWEC is required to contract with power producers for the purchase of all production capacity from licensed operators in the emirate. The DOE is authorised to allow 'by-pass sales' from power producers directly to eligible consumers provided that:

13 <https://www.dewa.gov.ae/en/customer/services/consumption-services/value-added-tax-or-vat>.

- a the first independent commercial power generation project in the emirates shall have commenced commercial operations;
- b the majority of the shares in the company are privately owned; and
- c the DOE issues a report stating that the energy market in the country is stable enough for it to be in the public interest that the sale of electricity by producers to eligible consumers be permitted.

To date, no 'by-pass sales' of electricity have been allowed by ADWEA (and now the DOE) in Abu Dhabi and all existing producers in the emirate are required to sell their production exclusively to EWEC.

Similarly, power producers in Dubai are obligated by law to sell their entire production capacity to DEWA.

All power generation companies in the northern emirates and Sharjah are required to sell their power production to FEWA or SEWA respectively.

iii Contracts for sale of energy

EWEC pays the generation companies the tariff agreed under the PWPAs. The PWPA serves both as a grant of concession and offtake agreement.¹⁴

The PWPAs usually have a term of about 20 to 25 years from the commencement of commercial operations. Payments to IWPPs by EWEC (formerly ADWEC) under PWPAs comprise three main components:

- a capacity (or availability) payments covering the fixed costs of the plant (return on capital, depreciation and fixed operating and maintenance costs);
- b operation and maintenance costs, paid when plant is available for production irrespective of whether and how much the plant produces; and
- c output (or energy) payments for variable operation and maintenance costs, payable only for the electricity actually produced by the plant and dispatched.

The primary fuel used in the power generation sector in the UAE is natural gas, accounting for 90 per cent of all production. As is often the case in such models, fuel costs are pass-through, and EWEC is required to procure and supply fuel to the electricity producers under the Abu Dhabi Electricity Laws. EWEC acquires the natural gas from two sources, the Abu Dhabi National Oil Company and Dolphin Energy Limited (purchased from Qatar via a pipeline connecting both states) for onward supply to the power producers.

Power plants are required to stock diesel oil and crude oil as backup fuel. According to the standard PWPAs, generation companies have to stock up enough backup fuel for their plants to run at full capacity for seven days.

PWPA payment rates under some of the agreements are subject to annual indexation against US and UAE inflation or the US\$/dirham exchange rate.

EWEC is required by the standard PWPAs to pay certain other supplemental payments to the IWPPs, such as start-up, shut-down costs and backup fuel costs. Some PWPAs may also have provisions for payment by the relevant party of liquidated damages for delay in performance and of interest on late payments.

To date, DEWA has only signed three power purchase agreements:

¹⁴ Jeffery Delmon and Victoria Rigby Delmon, *International Project Finance and PPPs: A Legal Guide to Key Growth Markets 2012*, p. 26 (2012).

- a the first with a consortium led by ACWA Power and TSK, for the Shuaa Solar PV Project, recently amended to include the fourth phase of the Solar Park;
- b the second with a consortium led by Harbin Electric International and ACWA Power for the construction of phase 1 of the Hassyan Clean Coal Project; and
- c the third with Masdar, for the 800MW third phase of the Solar Park.

V RENEWABLE ENERGY AND CONSERVATION

i Development of renewable energy

High energy use, encouraged by subsidised energy prices and the construction of energy intensive industries such as aluminium smelting has resulted in the UAE having one of the highest per capita carbon footprints in the world. The development of renewable energy is therefore crucial in reducing the country's carbon footprint and diversification of its economy away from fossil fuels. The UAE has announced that it aims to produce at least 7 per cent of electricity from renewable sources by 2020.

A number of showcase projects have been launched in Abu Dhabi and Dubai to kick-start the development of renewable energy in the country.

Abu Dhabi

Abu Dhabi established Masdar¹⁵ to spearhead the emirate's renewable energy initiative. Masdar City, a project of Masdar on the outskirts of Abu Dhabi city, is proposed to be run entirely on renewable energy as a zero carbon emissions city. Masdar City has also won the rights to host the headquarters of the International Renewable Energy Agency.

Masdar currently produces 17,500MWh of electricity annually, at its solar photovoltaic power plant located at the Masdar City for supply of clean power to the project. It has also launched a carbon capture and storage project in the UAE.

Most significant is Masdar's 100MW solar power plant¹⁶ at Madinat Zayed, which was inaugurated on 17 March 2013. Known as Shams 1, it is one the largest parabolic trough power stations in the world. This project is expected to be followed by the Shams 2 and Shams 3 solar power projects. Among other sustainable projects launched by Masdar in the UAE are Masdar City's 10MW solar PV array in Abu Dhabi, Masdar City's 1MW rooftop installations, a 100MW photovoltaic plant in Al Ain, a 30MW onshore wind farm on Sir Bani Yas Island, a grid-connected solar photovoltaic panel on Murawah Island, the Um Al Zomul solar photovoltaic plant, and a 543kWp photovoltaic plant that delivers energy to Rashid Abdulla Omran Hospital. With the success of its pilot project involving the installation of solar photovoltaic cells on 11 school and government buildings across the emirate, Masdar proposes to further expand the installation of solar panels to reduce dependence on hydrocarbon fuels.

Masdar is also actively expanding its international investments in clean renewable energy; some of its projects include the Seychelles wind power project (6MW), the Mauritania solar power project (15MW), Spain's Gemasolar (20MW), Valle 1 and 2 solar power projects

15 Masdar is a wholly owned subsidiary of Mubadala Development Company, one of the Abu Dhabi government's main investment arms.

16 The project company, Shams Power Company, is 80 per cent owned by Masdar and 20 per cent by Total SA.

(100MW), United Kingdom's Dudgeon offshore wind farm (402MW), Jordan's Tafila Wind Farm (117MW), Baynouna solar power project (200MW), Egypt's Siwa solar photovoltaic plant (10MW), Samoan wind farm on the island of Upolu (1,500MW), Serbia's Tesla wind farm (158MW), Tonga's Vava'u island solar power project (512KW), Scotland wind farm (30MW) and the Noor 1 and Noor 2 solar photovoltaic plants (250MW) in Morocco. Masdar is also a 20 per cent stakeholder in the London Array wind farm in the United Kingdom, which produces 650MW of electricity. In partnership with the International Renewable Energy Agency, the Abu Dhabi government also granted US\$57 million in loans to Argentina, Cuba, Iran, St Vincent and the Grenadines and Mauritania to finance renewable energy projects. Masdar is also involved with the UAE-Pacific Partnership Fund in developing renewable energy projects in the Pacific Islands. Currently, four new solar projects are under way in the countries of Kiribati, Fiji, Tuvalu and Vanuatu. An agreement was signed between Masdar and New Zealand to develop a solar photovoltaic power plant (1MW) in the Solomon Islands.

E.ON Masdar Integrated Carbon, a joint venture between E.ON and Masdar, develops and invests in carbon abatement projects in industry, power and oil and gas across Africa, Asia and the Middle East under the UN's clean development programme.

A 100MW waste-to-energy facility is currently under development in Abu Dhabi (near the Mussafah Sea Port) by TAQA, in coordination with the Centre of Waste Management (Tadweer). The plant was scheduled to be up and running by 2017 but there is no update on its current status.¹⁷

Dubai

The DSCE developed the Dubai Integrated Energy Strategy 2030 and Dubai Clean Energy Strategy 2050¹⁸ to enable Dubai to become a global centre for clean energy and green economy. In line with these strategies, Dubai aims to diversify its energy sources so that by 2030 it can fulfil 25 per cent of its energy demand from solar energy, 7 per cent from nuclear energy, 7 per cent from clean coal and 61 per cent from natural gas. By 2050, Dubai aims to fulfil 75 per cent of its energy demands from renewable energy sources.

As part of these strategies, in January 2012, Sheikh Mohammad Bin Rashid Al Maktoum, the Ruler of Dubai, launched the Solar Park. The Solar Park is expected to have a total installed capacity of 5,000MW by 2030. The project is being implemented by the DSCE in Dubai and managed and operated by DEWA. The first phase 13MW solar photovoltaic plant and substation was completed in 2013, followed by the second-phase Shuaa Solar PV Project in April 2017. The 800MW third phase was awarded by DEWA in June 2016 to a Masdar-led consortium and is expected to be operational in three phases commencing this year. DEWA also awarded the CSP project, as the fourth phase of the Solar Park to ACWA Power and Shanghai Electric, in September 2017.

In July 2013, Dubai launched a waste-to-energy conversion project through a landfill gas recovery plant at the waste collection site in Al-Qusais. To date, this is the first landfill in

17 <https://government.ae/information-and-services/environment-and-energy/water-and-energy/energy-/waste-to-energy->.

18 The Dubai Clean Energy Strategy 2050 was announced by the Dubai Supreme Council of Energy as part of its participation in the World Future Energy Summit held in Abu Dhabi in January 2017. The Dubai Clean Energy Strategy 2050 intends that 7 per cent of Dubai's total power output will come from clean energy by 2020, 25 per cent by 2030 and 75 per cent by 2050.

the region to run its entire operation with electricity generated from landfill gas. In due course, the plant is expected to increase capacity from its current 1MW to 20MW by 2020. Plans to implement a similar project in the Jebel Ali landfill are also proposed by the government.

In 2013, DEWA and DSCE established Etihad Energy Service Company (Etihad ESCO), which will serve, notably, to retrofit existing buildings and lower the water and energy consumption of such buildings.

DEWA has launched the Shams Dubai Initiative, which aims to encourage energy efficiency by equipping residential and commercial buildings with solar panels and connecting the panels to DEWA's electricity grid. In 2014, in line with this initiative, the emirate of Dubai issued Executive Council Resolution No. 46 of 2014 Concerning the Connection of Generators of Electricity from Solar Energy to the Power Distribution System in the emirate of Dubai (Resolution 46) to encourage the generation of electricity using solar panels. Resolution 46 enables DEWA consumers to supply power to DEWA's grid by connecting their solar panels and the power supplied to DEWA can then be adjusted against the consumer's electricity bill.

In 2015, Dubai established the Dubai Green Fund (Fund), worth US\$27 billion, which provides easy loans to investors in the clean energy sector. DEWA will provide the seed capital for the Fund, with additional investment from the private sector, international banks and large investment companies.

In 2016, DEWA inaugurated one of the largest single rooftop arrays in the Middle East and North Africa region, a 1.5MW direct current photovoltaic generation project at the Jebel Ali Power Station, and successfully connected it to DEWA's grid.

Currently DEWA is working to develop an Innovation Centre, equipped with the latest renewable and clean energy technologies to raise awareness on sustainability, while enhancing national capabilities and increasing competitiveness. The Innovation Centre will be equipped with the latest clean and renewable energy technologies, and will serve as a museum and exhibition for solar energy. The centre will also feature two solar testing facilities, the first will specialise in testing PV solar panels, while the second will focus on CSP. The centre is currently testing 30 photovoltaic panel types from global specialist manufacturers.

Dubai has also established the Dubai Carbon Centre of Excellence, responsible for encouraging and developing strategies towards reducing the emirate's dependence on carbon fuels and reducing carbon emissions.

In January 2018, DEWA signed a memorandum of agreement with the GCC Interconnection Authority and the Belgian Dredging, Environmental & Marine Engineering Group towards building a 400MW pumped hydro storage power station in the Arabian Gulf, with a storage capacity of approximately 2,500MWh.

The Dubai Municipality also announced the world's largest waste-to-energy project in the emirate's Al Warsan area, in early 2018. The plant is designed to treat 1.82 million tonnes of solid waste annually, with a total capacity to generate 185MW of electricity. Construction of the plant is proposed to begin mid-2018 and be completed in time for Expo 2020.

Sharjah

Like Dubai, Sharjah launched SEWA 2020 Vision in 2016 to enhance power efficiency in sustainable development. SEWA intends to reduce power and water use by at least 30 per cent over the next five years (i.e., by 2020). To achieve this vision, SEWA has launched various projects, which include: setting up the first electric-vehicle charging station, completing a

solar-powered road lighting project in Al Saja'a and Al Barashi, and replacing the current electrical infrastructure with modern facilities such as a smart metering system and networks to save energy.

Bee'ah and Masdar have formed a joint venture under the name of Emirates Waste to Energy Company (EWEC) to develop waste to energy plants across the Middle East. The first project being undertaken by EWEC is in Sharjah to establish a facility with the capacity to treat more than 300,000 tonnes of municipal solid waste a year, and with a power generation capacity of 30MW. EWEC and SEWA entered into a power purchase agreement in May 2017 for this project. The project is expected to be commissioned in the third quarter of 2021.

In March 2019, Bee'ah also opened an industrial waste water treatment plant in Al Saj'ah, Sharjah, with a daily processing capacity of 300 cubic metres.

Northern emirates

In 2014, UTICO, a privately owned utility company, called for the construction of a new 40MW solar plant in Ras Al Khaimah. UTICO has also collaborated with Shanghai Electric to set up a clean-coal power plant project (270MW) in Ras Al Khaimah. Both projects have been deferred indefinitely.

Recently, FEWA installed 11,000 smart electricity and water metres in Ajman. Additionally, in 2016, FEWA announced a 1.3 billion-dirham funding budget to improve the electricity network in the northern emirates. FEWA is expected to expand 17 power stations and construct 25 power distribution stations in Umm Al-Quwain, Ras Al Khaimah and Fujairah.

In 2017, the Ministry of Climate Change and Environment signed a memorandum of understanding with Masdar and Bee'ah for developing a waste-to-energy conversion facility to serve Ras Al Khaimah and Fujairah.

FEWA is also in discussions with the government of Ras Al Khaimah for developing a hydroelectric power project in Ras Al Khaimah.

Nuclear energy

The UAE is signatory to the Treaty on Non-Proliferation of Nuclear Weapons 1968 (signed in 1996), the Comprehensive Nuclear Test Ban Treaty 1996 (signed in 2000), and the Convention on the Physical Protection of Nuclear Material (signed in 2003), the International Convention for the Suppression of the Acts of Nuclear Terrorism 2005 (signed in 2008). The UAE has also signed the International Atomic Energy Agency (IAEA) Comprehensive Safeguards Agreement, IAEA Amendment to the Convention on the Physical Protection of Nuclear Protection of Nuclear Material and Nuclear Facilities and IAEA Additional Protocol to Safeguards Agreement.

The UAE aims to produce a significant part (approximately 9 per cent) of its electricity from nuclear technology. The UAE released a nuclear policy in 2008 and has since then promulgated a regulatory framework for development of nuclear energy in the country. In addition to collaborating with the IAEA and the World Association of Nuclear Operators, the UAE has signed cooperation agreements with France (2008), Korea (2009), the United States (2009), the United Kingdom (2010), Australia (2012), Canada (2012), Russia (2012), Argentina (2013) and Japan (2013) for the development of peaceful use of nuclear energy.

The Federal Authority for Nuclear Regulation (FANR), the federal nuclear energy regulator headquartered in Abu Dhabi, was established in 2009 under Federal Law

No. 6 of 2009 Concerning the Peaceful Use of Nuclear Energy. The FANR is tasked with the responsibility of setting up the procedures and measures to be followed for the development of nuclear technology in the UAE. The FANR has issued regulations governing, *inter alia*, licensing, site location, design, construction, commissioning and operation, as well as standards for safety, transportation and storage facilities, radioactive waste management and physical protection of nuclear materials. The UAE has also created the International Advisory Board (IAB), an independent body consisting of independent international experts on nuclear energy who will offer guidance to the country's nuclear programme on compliance with international safety, security and proliferation standards. The IAB is presently chaired by Hans Blix, the former IAEA Director General.

The UAE has been making rapid strides in establishing its first nuclear power station, the Barakah Nuclear Energy Plant (Barakah), in Abu Dhabi. The Emirates Nuclear Energy Corporation (ENEC), an Abu Dhabi government-owned company established by Federal Law No. 21 of 2009, is constructing Barakah, which will have a total capacity of 5,600MW. The project consists of the construction and installation of four 1,400MW reactors. As of December 2019, the project is more than 91 per cent complete and is proposed to be operational by 2020. Once the four reactors are online, the facility will deliver up to a quarter of the UAE's electricity needs.

In 2016, ENEC signed a deal with TRANSCO to transmit nuclear power generated from Barakah through TRANSCO's power lines to the ENG.

ii Energy efficiency and conservation

The UAE has one of the highest rates of electricity consumption per capita. This high usage is encouraged by the electricity and water subsidies given by the government to its citizens and in certain emirates to foreign expatriates. Dubai has progressively reduced and removed most of its electricity subsidies and Abu Dhabi is contemplating similar measures. Efficiency in energy usage is now being recognised as one of the key issues in trying to meet the country's growing energy needs in a sustainable manner.

In 2010, Abu Dhabi imposed a mandatory rating system for construction of energy-efficient buildings in the emirate under the Estidama initiative. Starting from September 2010, all new development communities, private buildings and villas in the emirate are required to meet the minimum of one-pearl rating. All government led projects have been mandated to meet a two-pearl rating (the highest being a five-pearl rating). Masdar City, an eco-city project within Abu Dhabi, plans to expand its community and target a four-pearl Estidama rating to set an example as the leading energy efficient community.

The Dubai government has also enacted the 'Green Buildings Regulations' to encourage sustainable building practices. These regulations are enforced by the Dubai Municipality and apply to all new buildings constructed (including changes or additions to existing buildings) in the emirate. To this end, RSB Dubai has licensed nine energy service companies to retrofit more than 30,000 buildings in the emirate of Dubai to make them more energy efficient. Recently, the Emirates Green Building Council issued the technical guidelines for retrofitting existing buildings.

In 2016, Dubai and Sharjah launched projects to replace current infrastructure with energy efficient facilities. Both emirates are currently replacing street lights with LED lights. In Dubai, existing buildings are currently being retrofitted by Etihad ESCO while Sharjah is replacing and renovating its cables and meters.

In 2016, SEWA created a unit called the Conservation Department with a target to help people conserve 30 per cent of their utility bills over five years by adopting best practices in usage of electricity, water and gas.¹⁹ In Ajman, the Green Building Committee of the Ajman Municipality and Planning Department was also formed to support energy conservation efforts.

To attract foreign private investment in the sector, Dubai has created a free zone dedicated to the development of green technologies and energy conservation, and known as the Energy and Environment Park (EnPark). EnPark is also Dubai's first master-planned community built on sustainable principles. In 2015, EnPark combined with another free zone, Dubiotech, to create Dubai Science Park.

Through recent investment in its transmission system, DEWA succeeded in reducing the percentage of line losses in its electrical network to 3.26 per cent in 2016 from 6.28 per cent in 2001 and has simultaneously increased the efficiency of its energy generation by 22 per cent between 2006 and 2014. As part of its demand growth management strategy, DEWA introduced a slab tariff that has been successful in reducing demand growth to 3 per cent despite a 5 per cent growth in end users in 2011. FEWA and the DOE also have slab tariffs in place for the northern emirates and Abu Dhabi respectively.

In October 2018, FEWA signed a memorandum of understanding with Honeywell to drive sustainable development and green economy initiatives in the UAE's northern emirates. Under this collaboration, FEWA will focus on amongst other things, driving significant energy savings (between 10–30 per cent) across a range of public sector buildings by adopting advanced energy efficiency technologies.²⁰

iii Technological developments

Masdar has established the Masdar Institute of Science and Technology (MIST), a state-of-the-art research centre and university, in partnership with Massachusetts Institute of Technology. MIST is a graduate-level university that aims to provide solutions to issues of sustainability, focusing on advanced energy and sustainable technologies, through research.

Although it is a brand new institute, according to its website, over 30 research projects are currently under way, covering solar beam down, innovation ecosystems, smart grids and aviation biofuels. In addition, according to its website, a number of patents are already pending registration.

MIST is likely to play a leading role in development of advanced technologies in the UAE in the coming years.

In 2015, Masdar launched Masdar Solar Hub, a solar testing and research and development hub for photovoltaic and solar thermal technology. In the same year, DEWA Innovation Centre, which consists of a laboratory for research and development in clean energy, was inaugurated.

Once completed, the Solar Park is expected to include, *inter alia*, the following: a centre for innovation equipped with the latest renewable energy technologies, a research and development centre to conduct tests in relation to social and industrial needs for renewable

19 <https://www.emirates247.com/business/energy/is-your-uae-utility-bill-too-high-reduce-it-by-up-to-30-2016-07-26-1.636801>.

20 <http://wam.ae/en/details/1395302716788>.

energy; two test technologies for photovoltaic panels and concentrated solar power; a solar testing facility; and a training centre and special conference centre for the exchange of information.

As of 2018, DEWA has signed a memorandum of understanding with Siemens to kick-off a pilot project for the regions first solar-driven hydrogen electrolysis facility at DEWA's outdoor testing facilities at the Solar Park in Dubai. In January 2019, DEWA and Siemens have also signed a memorandum of understanding to cooperate in research and development, exchange expertise and know-how, as well as building national capacities in energy technologies. The focus will be to pursue joint research and development activities in energy technologies including smart grids, the integration of renewable energy and distributed generation in the electricity grid, energy storage systems, the 'internet of things', using artificial intelligence in energy production unit, 3D printing and additive manufacturing, robotics, cybersecurity, robotics, and smart buildings, as well as building national capacities in the energy sector.²¹

VI THE YEAR IN REVIEW

The year 2018 marked the formation of the DOE and EWEC as a result of major restructuring of the energy and water sector in Abu Dhabi. EWEC and FEWA are said to be working towards unifying water production and power generation in the UAE.

The year also saw an increased number of private-sector companies striking deals with the electricity and water authorities in the emirates of Dubai, Abu Dhabi and Ras Al Khaimah for breakthrough projects. Power players like ACWA Power, Honeywell, Siemens, GE and Sumitomo Corporation are some of the key participants in the UAE energy space. This is in line with UAE's goal of diversifying the economic revenues and boosting the economy after the oil prices fell in 2014. Of particular interest is the contribution of the private sector in the renewable energy sector. Currently, the UAE has the lowest cost of producing solar power in the world, which can largely be attributed to the collaborations between the UAE government and private companies. The contribution of the northern emirates in the energy sector is also on the rise this year as more activity in terms of new projects and smart grids is seen in 2018.

Renewable energy is playing a major role in the energy sector in the UAE as projects are increasingly aiming at harnessing the natural resources of the UAE, particularly solar power due to its geographical location. The different phases of the Mohammed bin Rashid Al Maktoum Solar Park are on track and the aim is for the park to be home to projects generating up to 5,000MW by 2030. This follows the Dubai Clean Energy Strategy 2050. With a view to promoting and adopting renewable energy, IRENA has announced an annual summer trainee programme aimed at training UAE-based students for a career in renewable energy and sustainability.

The UAE has been at the centre of innovation and technology and is now utilising technology in the power sector. This is evident from several collaborations and MOUs signed by the federal government and the government of Dubai with innovation companies dealing in technologies such as the 'internet of things', artificial intelligence and blockchain applications in the power sector for smart energy management.

21 <https://www.dewa.gov.ae/en/about-dewa/news-and-media/press-and-news/latest-news/2019/01/dewa-and-siemens-sign-mou-to-cooperate-in-rd-in-energy-technologies>.

VII CONCLUSIONS AND OUTLOOK

The UAE is geared up for and appears to be on track to meet its Energy Strategy 2050, which was launched in 2017. Backed by impressive technology, it is well equipped to meet the ever-increasing energy demands and bring smart and efficient energy production and usage. Energy efficiency is also a top agenda item for the UAE.

In September 2019, the UAE is hosting the 24th World Energy Congress, the World Energy Council's flagship event attended by stakeholders, governments, industry experts and private corporations from across the globe. The aim of the Congress is for the attendees to share best practices and identify solutions for the key issues facing the energy sector globally. It will be interesting to see the resultant strategic partnerships, innovation, strategies and policies.

In addition to the focus on the energy sector at home, the UAE is also collaborating with and investing in other countries. Masdar has been deploying renewable energy technologies in a number of countries beyond the UAE, including Jordan, Afghanistan and Mauritania. IRENA and the Abu Dhabi Fund for Development have collaborated to support renewable energy projects in Rwanda, the Marshall Islands and the Caribbean. The UAE's efforts are designed to enhance its global leadership position via renewable energy diplomacy that will support access to affordable and sustainable sources of power for millions of people in developing countries around the world.²²

22 <https://www.thenational.ae/business/energy/uae-s-commitment-to-renewable-energy-can-enhance-its-global-leadership-role-1.771107>.

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