



Renewables in the Arab world: maintaining momentum

Renewable-energy developments in the Arab world have undoubtedly gained momentum in recent years. Many energy-importing countries, as well as the UAE, will continue to accelerate the development of their renewable-energy sectors, while Saudi Arabia has finally issued its first tender after much delay. The region has again received some of the lowest renewable-energy prices awarded globally, and with sources of renewable energy - most notably wind and solar - as plentiful as in any part of the world, the potential in the Arab world is great. Governments are accordingly rising to the challenge and improving the regulatory environment to attract investment in one of the fastest-growing segments of the energy industry.

Over the past decade, several Arab countries have announced ambitious renewable-energy targets. With power capacity requirements expected to increase at an annual rate of 6.4% until 2022, governments are keen to increase the share of renewables in the power mix. Shortage of gas and an increasing reliance on liquid fuels in some countries such as Saudi Arabia and Kuwait, a key product for export, has also added to the urgency of energy diversification, while increasing environmental concerns are an additional factor. Equally important, renewables continue to rapidly improve their cost competitiveness against other sources of power generation.

The contrasting realities facing net energy importers and net energy exporters mean that progress is mixed. To support their renewable sectors, the main energy-importing countries have introduced several supporting mechanisms including competitive bidding, the introduction of feed in tariffs (FITs), tax exemptions, and power-purchase agreements (PPA). On the other hand, energy-exporting countries – with the exception of the UAE - have done little to incorporate renewables, as they continue to rely on cheap-to-extract conventional resources to meet rising electricity demand. But this is starting to change, notably in Saudi Arabia, which finally issued its first tender for 300MW of solar PV. The continuing decline in technology cost has also given some countries an opportunity to move towards increasingly cost-competitive renewable energy, while

government support, as in other parts of the world, will be instrumental in driving growth of renewables in the region.

Morocco, Jordan and the UAE driving growth

Non-existent fossil fuel production and reliance on fuel imports to meet domestic demand and rising import bills have pushed Morocco and Jordan to diversify their energy sources. The two countries are leading the way for renewable development in the region and are heavily supported by European and international development organizations. In Morocco, the government's target of 2GW of solar and 2GW of wind power by 2020 is on track, with wind capacity already at over 800MW. The country has made further impressive developments in its wind sector: five wind projects totalling 850MW have already been awarded, with record bids ranging from \$25-30/MWh. As for solar, phase 1 of the Noor Concentrated Solar Power (CSP) project was commissioned in 2016, while Noor-2 and Noor-3 are expected to add a combined 350MW in 2018, which upon completion will become the largest CSP project in the world. The multi-billion dollar project is financed by international development agencies including the European Investment Bank (EIB) and the African Development Bank (AFDB). The country is also planning a hybrid solar project at Midelt in Central Morocco which will combine PV and CSP. The 1GW project will be built in two phases under the IPP model with a long-term PPA.

Renewable energy target by country

	Wind (MW)	PV (MW)	CSP (MW)	Other (MW)	Total (MW)	% of power mix	Target
Algeria	5,000	13,600	2,000	1,400	22,000	27	2030
Egypt	7,200	2,300			9,500	20	2022
Jordan	800	1000		50	1,850	10	2020
Morocco	4,200	4560		1330	10,090	52	2030
Tunisia	1,500	1,900	300		3,700	30	2030
UAE-AD	-	1500			1,500	7	2020
UAE-Dubai	-	5000			5,000	25	2030
KSA		9500			9,500	10	2023
Kuwait		4500			4,500	15	2030

Sources: RCREEE; IEA; APICORP Research

Like Morocco, Jordan has made impressive strides in its renewable sector in recent years. The country's commissioning of the 117MW Tafila wind project in the second half of 2015 was a milestone for the kingdom. The project had an estimated cost of \$287m and was financed by the International Finance Corporation (IFC), EIB, and other international institutions. The country is also expecting two major wind additions. Korea's Kepco 89.1MW Fujeij wind project, financed by the Korean export agency and Japan's Mizuho, will come on line in 2018. The second project is the 86MW Al Rajef wind project in Ma'an, financed by the European Bank for Reconstruction and Development (EBRD) and expected to come on line in 2019. Both projects operate under the Build, Own, and Operate (BOO) model with the Jordanian government guaranteeing to purchase electricity under a 20-year PPA. As for PV, the country will increase its initial target of 600MW to 1GW by 2020. The 103MW Quweira PV plant will come on line this year in southern Jordan – led by UAE's Enviromena and Spain's TSK. Several small solar plants each with a capacity of around 50MW are

China's JinkoSolar. Initially planned at 350MW, the consortium submitted a proposal for \$0.024/kWh and increased the plant's capacity to 1.18GW. The project will operate under a BOO model and will be owned by state utility Adwea (60%), Marubeni (20%) and JinkoSolar (20%). In Dubai, the 200MW Phase II of the Dubai Solar Park came on line in 2017 after achieving a then world record of \$0.0584/kWh. Phase III was awarded to a consortium led by Masdar, after receiving a bid of \$0.0299/kWh, with plans to bring 800MW on line by 2020. Another record was broken in the UAE when the phase four of the Dubai Solar Park achieved \$0.073/kWh for 700MW of CSP, expected to be the largest in the world. The plan was initially to build 200MW, but ACWA Power and Shanghai Electric increased the capacity of the project to achieve economies of scale. The plant is expected to begin commissioning by the end of 2020.

A more positive outlook for Egypt

Egypt announced plans to develop 2.5GW of wind, 1.7GW PV, and 100MW of CSP capacity by 2020, but more recently has

Major projects to come on line by 2020

Project	Location	Type	MW	Date	Financiers	Price (\$/kWh)	Contract	PPA
Taza	Morocco	Wind	150	2018	Local and Int. banks	0.068	BOO	20
Jbel-Sendouq Khalladi	Morocco	Wind	120	2018	Local and Int. banks	-	-	-
Gebel El Zeit	Egypt	Wind	220	2018	JICA	-	EPC	-
Gebel El Zeit	Egypt	Wind	160	2018	EU/EIB/KfW	-	-	-
Quweira	Jordan	PV	103	2018	ADFD	-	EPC	-
Fujeij	Jordan	Wind	89	2018	K-EXIM	-	BOO	20
Al Rajef	Jordan	Wind	86	2018	EBRD	-	BOO	20
Noor PV 1	Morocco	PV	170	2018	EIB/KfW	0.048	BOO	-
Noor II & III	Morocco	CSP	350	2018	AFDB/EIB/KfW	0.1567-0.1631	BOO	-
Sakaka	KSA	PV	300	2019	Natixis	0.0234	BOO	25
Sweihan	UAE	PV	1177	2019	-	0.0242	BOO	25
Gulf of Suez	Egypt	Wind	250	2019	JBIC/Int. banks	-	BOO	-
Tiskrad	Morocco	Wind	300	2020	EIB/KfW	0.025-0.030	BOO	20
Midelt	Morocco	Wind	150	2020	EIB/KfW	0.025-0.030	BOO	20
Jbel Lahdid	Morocco	Wind	200	2020	EIB/KfW	0.025-0.030	BOO	20
Boujdour	Morocco	Wind	100	2020	EIB/KfW	0.025-0.030	BOO	20
Tangier II	Morocco	Wind	100	2020	EIB/KfW	0.025-0.030	BOO	20
Dubai Solar Park III	UAE	PV	800	2020	IDB/NBAD/FGB	0.0299	BOO	25
Dubai Solar Park IV	UAE	CSP	700	2020	ICBC	0.073	BOO	-

Sources: MEED Projects; APICORP Research

currently under development, financed by various international institutions and banks. More recently, the UAE's renewables company Masdar announced that it will build a 200MW PV plant in Jordan, which will be backed by the IFC and is expected to come on line in 2020. All told, the country has around 700MW of solar and wind projects under development or planned by 2020.

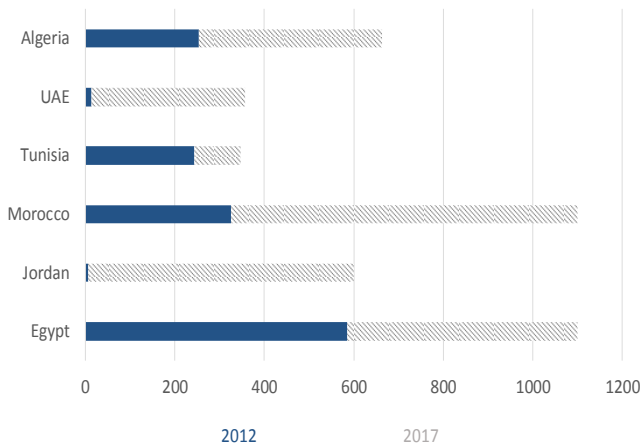
The UAE has invested heavily in developing its solar energy. The first solar project to come on line in 2014 was the 100MW Shams CSP plant in Abu Dhabi. The cost of the project was \$600m and was financed by a consortium of international banks including BNP Paribas, National Bank of Abu Dhabi and Mizuho. Abu Dhabi's Sweihan PV project broke the then-price record previously set by 800MW phase 3 of the Dubai Solar Park, having received the lowest bids from Japan's Marubeni and

been struggling with its ambitious program. The country's current wind capacity stands at around 800MW with two projects coming on line this year, adding 480MW. The latest project to be awarded at the end of 2017 was a 250MW wind farm, which was won by Engie, Tsusho, and Orascom under the BOO model. The project is expected to cost \$400m and will be financed by several international banks including the Japanese Bank for International Corporation and Société Générale.

Solar projects have been slower to progress in Egypt, but the country is pushing through with its plans to develop a 1.8GW solar park in Benban. Recently, the EBRD and IFC committed to lend \$1.6bn for 27 solar projects throughout the country, with financial closure for 400MW to be developed by Norway's ScatecSolar.

Although there has been strong interest in the Egyptian market, the country's low foreign reserves, weakening pound, and arbitration rules which dictated that settlements be made in Egyptian courts were all major concerns to international investors. More recently, though, these concerns have eased, as tariffs and the government's insistence that disputes are settled in Egyptian courts have finally been resolved. Financing remains the government's biggest obstacle, but the growing commitment of international lenders such as the IFC and EBRD is helping attract much needed funds into the sector.

Estimated renewable energy capacity (MW)



Source: IRENA; APICORP Research

Saudi Arabia issues first tender

The Kingdom has finally kickstarted its ambitious renewable energy plan where it aims to achieve 3.5GW by 2023 and 10GW by 2030. The previous renewable energy plan was placed under the King Abdullah City for Atomic and Renewable Energy (KACARE), which in 2012 envisaged investments of \$109bn to produce 54GW of renewables and nuclear by 2032. While the main obstacle behind renewable deployment in most countries is financial, the Kingdom's original renewable plan never kicked off due to a preference to rely on conventional power plants to meet the increase in electricity demand and the absence of supporting policy frameworks for renewable programs. However, this is currently being addressed, with the newly formed Ministry of Energy, Industry, and Mineral Resources taking charge of the country's renewable-energy programme. The Renewable Energy Project Development Office (Repdo), a dedicated unit to oversee the programme, will report to a renewable-energy steering committee chaired by the Minister Khalid al-Falih.

After several delays in issuing the first tender, developments are finally underway. The first utility-scale solar project was recently awarded to ACWA Power. The 300MW Sakaka PV project – to be located in the AL-Jawf region - achieved a world-record price of \$0.02342/kWh and will operate under a long term PPA. Although the ACWA Power bid was the second lowest bid for the tender, the lowest bid submitted by Masdar and EDF (\$0.0179/kWh) was disqualified for not meeting certain criteria and standards. As for wind, progress is also apparent, albeit at a slower pace than solar. The government has received four bids for the first wind project, expected to hold a capacity of 400MW in Al-Jawf region. The four bidders are EDF, ENEL, Engie, and

ACWA Power, but the government has yet to announce the date in which they will open the bids and award the contract.

Supporting policies paving the way

Regulatory support is improving as several countries accelerate the expansion of their renewable sectors. The initial government support mechanism in Jordan and Egypt was through Feed-in-Tariffs. In Jordan, the first round of tenders in 2013 led to the procurement of 200MW of PV over 12 projects, of which 11 received a FiT of \$0.160/kWh and the 52.5MW Shams Ma'an project, expected on line by the end of 2016, received \$0.149/kWh. The second round of tenders – concluded in 2015 through competitive bidding – led to the procurement of an additional

Renewable energy supporting policies

	Renewable energy law	Targets	Auction schemes	FiT/Feed-in premium	Capital grants	Tax relief	Net metering	Carbon pricing
Algeria	✓	✓	-	✓	-	✓	-	-
Egypt	✓	✓	✓	✓	-	✓	✓	-
Iraq	-	✓	✓	-	-	-	-	-
Jordan	✓	✓	✓	✓	-	✓	✓	-
Lebanon	-	✓	-	-	-	-	✓	-
Morocco	✓	✓	✓	-	✓	✓	✓	-
KSA	-	✓	✓	-	-	-	-	-
Tunisia	✓	✓	-	-	✓	✓	✓	-
UAE	✓	✓	✓	-	✓	-	-	-

Source: IEA, APICORP Research

200MW of PV divided in four 50MW projects. The offers for the four 40MW plants were \$61.3/MWh, \$64.9/MWh, \$69.1/MWh and \$76.7/MWh, around 50% less than the FiTs offered in the previous tender round. The government offered FiTs in the first round to attract foreign investment. But there has been a change in strategy as governments now prefer to offer tenders under competitive bidding which attract very low prices. Given the very competitive prices it was able to secure, the government is unlikely to revert back to FiTs for future projects.

However, the main incentive for private developers will be government-backed long-term PPAs, under which state utilities guarantee to purchase produced electricity on a 'take or pay' basis. This complements the competitive auction scheme where developers are invited to bid and compete for renewable projects. This process has been credited for the continuously falling prices achieved in the region. Other economic support mechanisms in the region include tax reliefs, net metering, and capital grants - while regulatory support mechanisms include renewable energy laws and national targets. More importantly, governments are showing stronger political will to integrate renewables into the power mix.

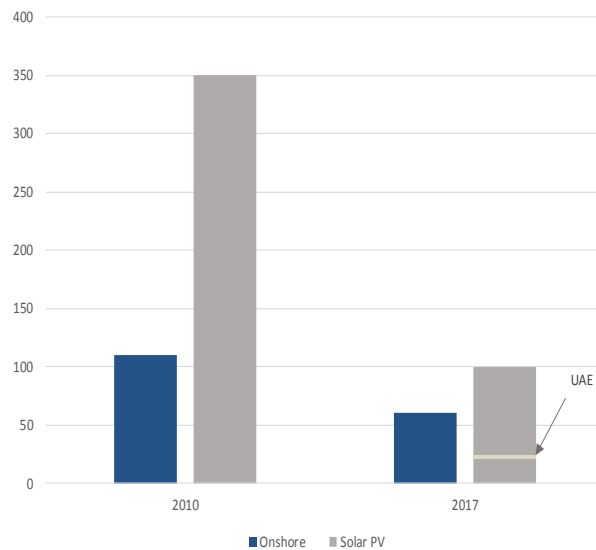
Costs continue to fall

The success of renewable energy will ultimately rely on cost competitiveness. Between 2010 and 2015, average costs for solar PV energy decreased by 70% and for wind energy by 30% globally, according to the International Energy Agency. An additional 25% and 15% decline, respectively, is expected between 2017-22. The cost savings are mainly attributed to technological advancements and economies of scale due to

increased manufacturing activities in Asia. Continuing investments and additional capacity will result in further cost reductions.

The last few years have seen some of the lowest renewable-energy prices in history. In 2016, the region broke records set in 2015 when Morocco received average bids of \$0.03/kWh for five wind projects and the 800MW phase III of the Dubai Solar Park received \$0.0299/kWh. The solar record was again broken in 2017 by the 1.18GW Sweihan PV project in Abu Dhabi, which received \$0.024/kWh from Asian companies Marubeni and JinkoSolar, but Saudi Arabia then raised the bar further, with developer ACWA Power offering pricings of \$0.02342/kWh. Substantial progress in pricing has also materialised for CSP, where the 700MW phase IV of the Dubai Solar Park achieved \$0.073/kWh, breaking the global CSP record held by Morocco's Noor 1 since 2013 of around \$0.19/kWh. These prices are very promising for the region, given that Qatar and, to a lesser extent Algeria, are the only Arab countries with abundant cheap natural gas. Based on these pricings, solar PV and onshore wind are capable of undercutting conventional sources in some countries, despite the widespread perception that renewables are not cost competitive.

Global weighted average LCOE (\$/MWh)



Source: IRENA; APICORP Research

But slow progress in other countries

However, other net-exporting countries are struggling to kick start their programs. Large oil and gas reserves and cheap extraction costs mean that hydrocarbons continue to meet rising demand in countries like Kuwait, Qatar and Algeria, and policy uncertainty and lack of an efficient and supportive regulatory framework are also contributing to slow progress.

Kuwait declared a 15% renewable-energy target by 2030 but only has the 50MW Al-Shagaya CSP plant under development. In Oman, the government is expected to issue a tender for the development of its first utility scale PV.

Elsewhere, Qatar and Bahrain have made minor investments in renewables, but with no significant additions expected in the short term. In Algeria, the government announced plans to develop around 4GW of PV by issuing three tenders, each for 1.35GW. So far, though, much uncertainty surrounds renewable progress in the country.

Despite many claims that renewable energy will never reach its potential unless fuel subsidies are phased out, such subsidies are just one of the factors to consider for renewable development and are perhaps not the most important, as other factors such as electricity-market structure are starting to play a more important role. Currently almost all rely on a state-owned wholesale entity to buy and sell electricity. Government wholesale buyers decide the purchase price of electricity from generators as well as the selling price to consumers. If governments want to keep prices low for end-consumers, there is nothing to prevent them from incentivising renewable energy sources the same way as they subsidise electricity prices from conventional sources. The current single-buyer model is one of the main reasons of recent success, as developers are happy to sign PPAs with the single buyer.

However, the main players (i.e. state utilities) in the current electricity-market structure have been less enthusiastic about the deployment of renewables, not least because it disrupts their business model and erodes their revenues base and could eventually result in job losses, because state owned utilities not only provide an essential product but are also big employers. Increasing the share of IPPs and renewable power causes friction, which should be addressed by governments undertaking structural power market reforms, but these have been occurring at a very slow pace.

Nevertheless, there are many reasons to be optimistic about the future of renewables in the region. Net-importing countries such as Morocco and Jordan, driven by their desire to reduce dependency on fuel imports even in a lower oil price environment, will continue to lead the drive for renewable energy in the region. Falling costs have provided great impetus for the deployment of renewables and will continue to be a key factor. Financing is becoming more obtainable, but countries need to continue developing their regulatory framework to attract investment into this sector.

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