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February 2018

Mohammed Ben Rashid Solar Park 1. Picture by Ghadir Shaar Awarded best solar Picture of the Year

MIDDLE EAST SOLAR INDUSTRY ASSOCIATION

SOLAR OUTLOOK REPORT 2018



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INTRO DUCTION

IN 2017 WE SAW THE COMPLETION AND SUCCESSFUL COMMERCIAL OPERATION OF THE SECOND LARGE-SCALE SOLAR PHOTOVOLTAIC (PV) PLANT IN THE MIDDLE EAST.

Low prices of solar energy have led policy-makers, regulators and industry leaders to take a number of steps to increase and accelerate the adoption of solar power throughout the Middle East and North Africa (MENA) region. Most notably, countries that were late to adopt solar-energy strategies and policies have now put forward ambitious targets. Countries with solar plans in place in terms of megawatts installed have substantially increased those targets. Finally, scaling up the size of solar projects has allowed nations to capture value across the value chain.

In 2017 we saw the completion and successful commercial operation of the second large-scale solar photovoltaic (PV) plant in the Middle East.

The construction of Dubai Electricity and Water Authority's (DEWA) 200 MW phase II of the Mohammed bin Rashid Al Maktoum Solar Park was successfully completed one month ahead of schedule. DEWA revealed the plant was built at a cost of AED1.2 billion (US\$326.7 million). The year showed similar trends of competitive levelized cost of electricity (LCOE) for solar projects to those observed over the past couple of years throughout the region. The Renewable Energy Project Development Office's (REPDO) 300 MW Sakaka project in Saudi Arabia reported the lowest PV LCOE (2.34 US\$ cents per kWh) in the MENA region. Other large-scale deals that reached financial closure in the MENA region in 2017 were the MASEN 170 MW Ouarzazate IV PV in Morocco and the ADWEA 1GW PV. In addition, a number of the 1.4 GW of PV projects under Egypt's Round II feed-in tariff (FiT) have reached financial closure and started construction.

The 2.34 US\$ cents per kWh contract awarded by REPDO to ACWA Power for the 300 MW Sakaka project was amongst the world's lowest unsubsidized solar-power prices. A world record low tariff of 1.77 US\$ cents per kWh was set in Mexico in 2017 by Italian developer Enel under certain bid conditions and structure, which were not applicable in the MENA region 2017 tenders. These low tariffs led to further solar-energy capacity announcements across the region (e.g. Bahrain, Egypt, Jordan, Kuwait, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, UAE), and all these countries are targeting large-scale project announcements in 2018 and early 2019.

However, it isn't just large commercial-scale projects that are gaining momentum. Commercial and industrial rooftop solar started to show growth trends across the MENA region. Jordan, Oman, Pakistan, Saudi Arabia and UAE are at different stages of establishing or operating regulatory frameworks and pushing for meaningful megawatts of rooftop PV installations in 2018 and 2019.

By massively adopting solar, the MENA region is accelerating its energy transition which can be summarized in 5 Ds: Decarbonization, Decentralization, Decoupling, Digital and Distributed.

DECARBONIZATION: The adoption of solar will lead to signification reduction in the region's carbon footprint while saving natural gas for future or other use. Solar power, combined with the reduction of energy subsidies or adoption of cost-reflective tariffs, has increased public awareness as well. As a result, less conventional projects have been launched over the past few years.

DECENTRALIZATION: This concept merges the technological energy transition (from conventional to renewable and from centralized to decentralized) while strengthening public and private participation. Further large-scale solar projects, or even commercial and industrial solar, will continue the decentralization of energy systems across the region by increasing private energy production and even distribution ownership. New actors could become part of the energy landscape in the near future: prosumers, renewable-energy cooperatives and community-owned power stations.

DECOUPLING: The Middle East is historically one of the regions where conventional projects were coupled with thermal desalination technologies to fulfill the region's potable water needs. The reduction in solar prices, combined with technological advancements and further cost reductions of reverse osmosis, have led to desalination capacity being tendered as stand-alone, independent water projects (IWPs).

DIGITAL: These technologies will make energy systems across the region more connected, intelligent, efficient, reliable and sustainable. Advances in data analytics and connectivity are enabling a range of new applications, such as smart appliances and shared mobility, to accelerate in the MENA region. Digitized energy systems are more accurate in identifying load and production management, helping to drive down operation costs. Establishing the right systems for individual networks in the region will take time, but there are some promising pilot projects underway.

DISTRIBUTED: Distributed power generation will eventually be combined with battery storage and generated by a variety of small, grid-connected devices. Rooftop and industrial solar projects are the most typical examples of distributed energy generation in this region.

For MESIA's Solar Outlook Report 2018, we added two new sections: a section about electrical vehicles and another about digitalization.

A special word of thanks to our MESIA members who were instrumental in contributing, reviewing and commenting on the draft versions of this edition, as well as Gurmeet, Kanav, Micheline and Waseem from our MESIA association.



WIM ALEN

General Secretary MESIA On behalf of the MESIA Board

SOLAR TRENDS 2. N 2018

FOR 2018 WE EXPECT THE FOLLOWING SOLAR TRENDS IN THE MIDDLE EAST AND NORTH AFRICA:

1. Construction of PV plants:

The construction of DEWA's Phase III and ADWEA's Sweihan mega-PV projects in the UAE has started. In addition, the 1.4 GW of solar PV projects under Egypt's Round II FiT scheme and the MASEN 170 MW Ouarzazate IV PV in Morocco are also underway.

Table 1 to 4 below provide the latest update of solar projects (PV, CSP, ISCC and EOR) across the region in 2017 that are (i) awarded or under tender, (ii) under construction and (iii) in operations.

COUNTRY	AWARDED / TENDER	CONSTRUCTION	OPERATIONS
AFGHANISTAN	30	10	
ALGERIA			353
EGYPT		1,800	30
JORDAN	52	453	467
KUWAIT		50	10
MOROCCO		520	180
PAKISTAN		100	
SAUDI ARABIA	300		
UAE	760	1,970	323
TOTAL	1,142	4,903	1,363

Table 1: Solar (PV, CSP, ISCC) installation overview in MWAC (this table includes neither rooftop projects nor large-scale projects below 10 MW)

Source: Middle East Solar Industry Association (MESIA) - Solar Outlook Report 2018

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ALEC ENERGY is a provider of financially sound green energy solutions and delivers an efficient turnkey solar solution for your commercial & industrial rooftops at no capital cost. An enhanced oil recovery project of 100 MW thermal developed by GlassPoint has reached commercial operation date in Oman.

 Table 2: Solar (EOR) installation overview in MW THERMAL

COUNTRY	AWARDED / TENDER	CONSTRUCTION	OPERATIONS
OMAN			100

Source: Middle East Solar Industry Association (MESIA) - Solar Outlook Report 2018

2. Volatile pricing of solar panels:

MESIA expects the cost of solar panels to go down over the longer term. Nevertheless, panel pricing is expected to be volatile over the coming 1.5 years due to regulatory and demand changes in both China and the United States. However, significant bargaining power is expected to remain with developers of large and mega-size PV projects starting in 2019/2020.

3. Increased cost of debt for new projects:

Infrastructure and renewable projects continued to benefit in 2017 from a low-cost funding environment, despite quantitative easing coming slowly to an end. We saw interest rates rise in 2017, with three more rate hikes on the horizon in 2018. This will impact, even if marginally, renewable-energy tariffs as the cost of lending rises.

4. Very low LCOE offers worldwide:

2016 and 2017 were characterized by world record-low tariffs across MENA. We continued to witness solar independent power projects (IPP) bids and engineering, procurement and construction (EPC) contracts with very low LCOEs in 2017, but other regions, like Latin America, are securing similarly low tariffs. It is important to note, however, that most of the LCOEs are difficult to compare due to structural differences: regulatory regime (contracted vs. merchant), solar irradiance, tax regime, land cost, grid-connection costs, just to name a few.

5. Increased oil and gas prices:

Increasing hydrocarbon prices did not slow down solar growth in the Gulf Cooperation Council (GCC), but rather had the adverse effect. Both net importers and exporters see the benefit of investing in solar projects. Net importers see solar power as a way to diversify their power generation mix and to reduce the fuel-import bills. In addition, net exporters see solar power as an opportunity to decrease local fuel consumption and reduce fossil-fuel subsidies while finding export opportunities and alternative uses in other industries.

6. Energy independency:

With solar PV LCOEs now well below current market prices for oil, natural gas, and certainly imported liquefied natural gas (LNG), energy importing countries, such as Jordan, Morocco and Pakistan, will keep driving growth for large-scale solar-power plants.

7. Pick-up in storage solutions:

Today, solar PV without storage is at grid parity throughout the MENA region, but mainly acts as a fuel-saver. The importance of reliable base-load power from solar resources is highlighted by the increased importance of storage, e.g. DEWA's 700 MW Phase IV CSP, DEWA's study for building a 400 MW pumped hydro-storage power station in the Arabian Gulf, and Jordan's 30 MW / 60 MWh battery-storage tender. These are all part of the region's efforts to diversify its energy mix while adopting different types of storage technologies.

8. Growth in commercial and industrial solar solutions sometimes combined with storage:

Lower prices for solar coupled with increasing electricity rates will further lead to the adoption of distributed solar (mainly rooftop) in 2018. In addition, significant cost reductions in battery technology make it worthwhile to use batteries to provide 24/7 energy solutions in remote areas while displacing diesel.

9. Small-scale distributed generation initiatives:

Regulation, like net metering or deployment targets making solar mandatory, will push distributed solar-power generation. One example is with Dubai's Shams program, which plans to have solar power on every rooftop in the emirate by 2030. Many countries made significant progress promoting small-scale distribution initiatives and this trend will continue.

8



SOLAR OUTLOOK REPORT 2018

SOLAR PROJECTS 3. IN 2018

Table 3: PV pipeline 2018

COUNTRY	COUNTRY	CAPACITY	STATUS	CLIENT
BAHRAIN PV	Bahrain	200	Announced	EWA
SOLAR IPP (WEST NILE)	Egypt	600	Prequalification	NREA
SOLAR IPP (KOM OMBO)	Egypt	200	Bid Stage	EETC
ROUND 3	Jordan	200	Bid Stage	MEMR
RISHA PV	Jordan	50	Financial Close	NEPCO
WATER AUTHORITY JORDAN	Jordan	30	Prequalification	Water Authority Jordan
KNPC	Kuwait	1,000	Bid Stage	KNPC
NOOR MIDELT	Morocco	800	Bid Stage	MASEN
IBRI	Oman	500	Prequalification	OPWP
PDO - 100MW	Oman	100	Prequalification	PDO
QATAR PV	Qatar	200	Announced	Kahramaa
MULTIPLE SITES	Saudi Arabia	6,400	Announced	REPDO
TUNISIA PV	Tunisia	70	Bid Stage	STEG
TOZEUR PV	Tunisia	10	Bid Stage	STEG
SWEIHAN II	UAE	1,200	Announced	ADWEA
DEWA PHASE V	UAE	300	Announced	DEWA
TOTAL		11,860		

Source: Middle East Solar Industry Association (MESIA) – Solar Outlook Report 2018

Table 4: CSP pipeline 2018

COUNTRY	COUNTRY	CAPACITY	STATUS	CLIENT
TAQA CSP	Egypt	250	Announced	TAQA Arabia
WEST NILE CSP	Egypt	100	Announced	
LEBANON CSP	Lebanon	50	Announced	
NOOR MIDELT	Morocco	800	Bid Stage	MASEN
TOTAL		1,200		

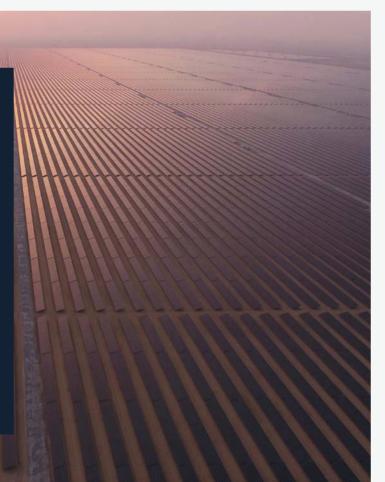
Source: Middle East Solar Industry Association (MESIA) – Solar Outlook Report 2018

LARGE SCALE PV PROJECTS

ELECTRICITY DEMAND IN THE MENA REGION HAS HISTORICALLY BEEN GROWING BETWEEN 4 AND 8 PERCENT PER ANNUM (CAGR), DEPENDING ON THE TIMING IN THE ECONOMIC CYCLE.

In order to help satisfy this need for energy, the Middle East has been setting new benchmarks both in terms of adopting large-scale solar-power plants and achieving very low benchmark tariffs. In the GCC, for example, REPDO achieved 2.43 US\$ cents per kWh confirming that the benchmark for solar PV is now well below 3.0 US\$ cents per kWh in the GCC. The region's energy market will be impacted by these low solar prices, even more as fuel and electricity subsidies are being gradually removed across the region.

We are witnessing rapid adoption of large-scale solar in the Middle East with regional utilities constructing solar plants with capacities on the gigawatt scale. In 2014, Egypt had about 20 MW of CSP in operation and just a few PV installations; the country is now aiming for 2,650 MW of PV capacity in operation by 2020. Morocco will have 170 MW of PV in operations by 2019. Next door, Jordan has PV projects in operations, under construction and is set to award another 200 MW in the course of 2018.



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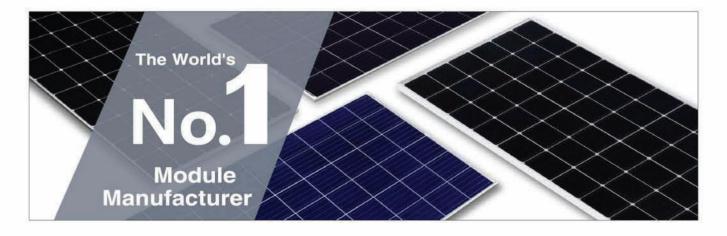


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4.1 HIGHLIGHTS IN MENA'S LEADING SOLAR PV MARKETS

This overview provides an outline of the biggest solar markets in the Middle East in 2018. Countries are presented in alphabetical order while the projects listed are focused on the larger-scale deals without intention of being fully exhaustive.

4.1.1 Afghanistan

- Despite low electrification rates, Afghanistan relies on energy imports. The country is taking steps to make use of its abundant solar irradiation to develop projects over the coming years. The country's renewable-energy policy is targeting 4 to 5 GW of renewable energy capacity by 2030.
- Construction began on a 10 MW solar-power project located at Kandahar by Dynasty Oil & Gas of India, with US\$10 million funding by USAID. The remaining cost will be covered by the contractor. Operation of the plant is expected to commence from August 2018 after Afghan national electric utility Da Afghanistan Breshna Sherkat (DABS) and Dynasty signed a 15-year power purchase agreement (PPA) at a tariff of 7.3 US\$ cents per kWh.
- Asian Development Bank approved a grant of US\$44.76 million for the development of a 20 MW solar PV project in capital Kabul's Surobi district. The project is expected to be completed in 18 months after its construction contract is signed.
- In January 2018, the High Economic Council (HEC) of Afghanistan approved construction of a 30 MW solar PV power plant in the province of Kandahar. Around US\$39 million will be invested in developing the project, which is expected to take around two years to complete.
- During the latter half of 2017, Afghanistan's National Procurement Authority issued three tenders for the construction of three hybrid solar-power plants totaling 55.5 MW. The closing date for all three tenders was in October 2017.

4.1.2 Bahrain

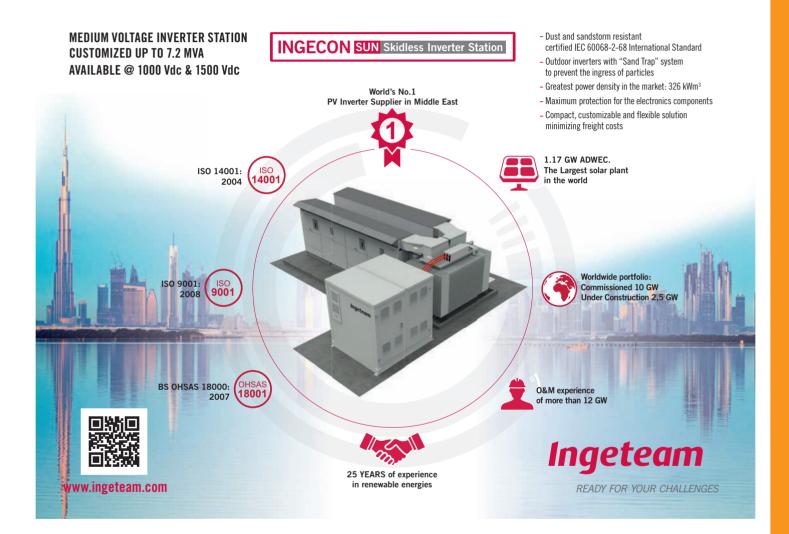
- As part of its National Renewable Energy Action Plan (NREAP), Bahrain plans to bring 255 MW of PV capacity online by 2025 and 700 MW of PV capacity by 2030.
- Bahrain plans to tender a 100 MW solar-power plant in the first quarter of 2018, using the IPP model. The tender process is expected to be launched in February 2018 while the power plant is expected to be completed in 2019.
- Bahrain's first solar-panel manufacturing and production facility was inaugurated at the start of 2017. The plant is located in the South Alba Industrial Area and has a manufacturing capacity of 60,000 panels per annum, which is equivalent to 15 MW of power.

4.1.3 Egypt

- As electricity prices are expected to rise in Egypt, the country is spearheading the development of 1.4 GW of total generation capacity as part of the second round of its FiT scheme. The second round of the FiT program was revised, decreasing the tariff rates while addressing international arbitration. Numerous other solar projects have been approved and will begin development over the next couple of years.
- The following are updates to projects being developed in the 1.8 GW Benban complex:
 - 1. US\$660 million has been approved by the International Finance Corporation (IFC) for the development of 11 solar plants with a cumulative capacity of 500 MW.
 - 2. The European Bank for Reconstruction & Development (EBRD) approved US\$500 million for 13 independent solar plants.
 - 3. The African Development Bank (AFDB) also approved a loan of US\$55 million for 3 independent solar projects.
 - 4. Norway's Scatec Solar signed up the largest number of PPAs for 6 solar projects with a combined capacity of 400 MW at the complex.
- The Egyptian Electricity Transmission Company (EETC) issued a 600 MW tender under the new auction scheme, the first tender outside the FiT scheme. Selected projects will be built under build, own and operate (BOO) policy.

4.1.4 Jordan

- Due to Jordan's heavy reliance on fossil-fuel imports, the government's national energy strategy is to generate 10 percent of its energy needs from renewable energy sources by 2020. A number of projects were announced in 2017, showing positive signs that the country is steadily moving toward its clean-energy targets.
- In late March 2017, ACWA Power signed a PPA for a 61 MW solar plant in eastern Jordan. The PPA was signed with Jordan's local utility called National Electric Power Company at a tariff of 5.9 US\$ cents per kWh, one of the lowest in the country.
- In December 2017, Wärtsilä signed a contract to provide the EPC services for a 52 MW solar PV plant. The plant is owned via a joint venture between AES Jordan PSC and Mitsui & Co. Construction and is expected to begin in June 2018 and come online in July 2019.
- Baynouna, located east of Amman, is a 200 MW solar-energy project that is being developed by Masdar and Jordan's National Electric Power Company. The US\$260 million project funded by the IFC is expected to be operational in 2019 after its construction began in late 2017.
- Mafraq I and Mafraq II are two independent solar PV plants that will be developed by Fotowatio Renewable Ventures (FRV) in Jordan's Mafraq region. With a combined investment of US\$180 million and a total generation capacity of 133.4 MW, the two projects are expected to reach completion by mid-2018. The rates for electric unit generated by Mafraq I and Mafraq II have been declared to be 6.9 and 7.6 US\$ cents per kWh respectively, which falls below the average rate of electricity for Jordan.
- The Quweira solar power plant, which is a 103 MW facility located in the south of Jordan near Aqaba, was constructed by TSK & Environmena and started injecting power into the grid at the beginning of 2017.
- The Green Corridor project, which is meant to upgrade the electricity grid, is expected to enter service by the end of 2018.





Projects in MENA region Abu Dhabi 1177 MWp | Egypt 200 MWp | Morocco 175.5 MWp | Jordan 60 MWp

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4.1.5 Kuwait

- Kuwait is aiming to generate 2 GW of renewable energy capacity by 2030 in order to diversify its energy mix and reduce its dependence on fossil fuels.
- In the first quarter of 2018, the country will issue tenders for the US\$1.2 billion Dibdibah solar facility, which will have an estimated capacity of 1 GW. The 12.3 square mile solar plant located in Kuwait's northwest region is expected to be completed by 2020.

4.1.6 Libya

- Libya's most prominent energy source is crude oil and a small renewable energy sector. Highly subsidized energy prices make it difficult to promote renewable energy technologies. Given the country's geographical location, it has great potential to take advantage of the abundance of solar energy in the region.
- A 50MW solar PV plant is being proposed. The plant will be connected to the Misruta Free Zone grid. Any excess power will be sold back to the Libyan national grid system owned by General Electricity Company of Libya (GECOL).

4.1.7 Morocco

- Due to its large volume of imported fossil fuels, the Moroccan government has committed to increasing the share of renewables in the energy mix to 42 percent by 2020 and 52 percent by 2030. A minimum capacity of 2 GW of CSP and PV has been targeted by 2020.
- The Noor II 200 MW CSP Power Plant and Noor III 150 MW CSP plants (part of a 580 MW solar power complex in Ouarzazate) are still under construction.
- Morocco's King Mohammed VI launched the construction of the 170 MW Noor Ouarzazate IV PV plant in April 2017. The 170 MW plant is scheduled for completion in the course of 2018.

4.1.8 Oman

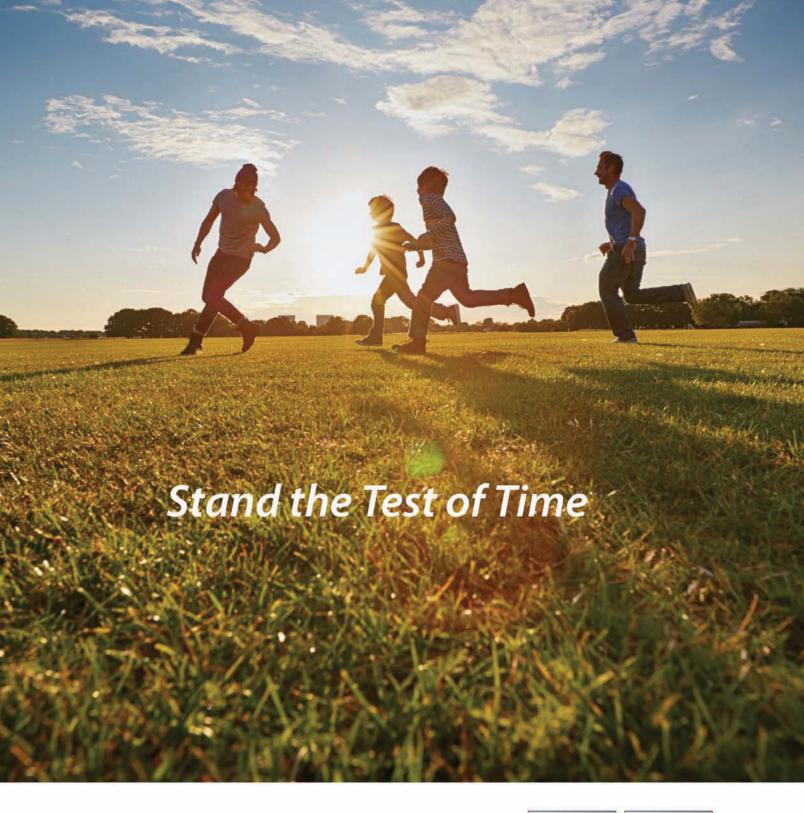
- Oman is also committing to a long-term renewable energy generation plan by aiming to add around 4 GW of renewable energy capacity by 2030. The new renewable energy capacity should represent 25 percent of the installed capacity and reach 10 percent of the energy produced.
- At the end of 2017, the Oman Power and Water Procurement Company (OPWP) issued a Request for Qualification (RFQ) for a 500 MW solar PV project. The project is to be located in Ibri, in the west of the country, and is expected to cost approximately US\$500 million. The Request for Proposal (RFP) for the project is stated to be issued in the first quarter of 2018.
- Similarly, Petroleum Development Oman (PDO) has launched an RFQ for a 100 MW solar PV project. The RFP is expected to be launched soon.
- On February 13, 2018, the Miraah solar plant was inaugurated by H.E. Salim bin Nasser Al Aufi, Undersecretary of the Ministry of Oil and Gas, PDO, and GlassPoint Solar, at the Amal oilfield. The plant, which will consist of solar steam generators, is partially completed with four blocks of 100 MWt capacity installed. Construction began in 2015 and the entire project is supposed to consist of 36 blocks. The project delivers steam to the Amal oilfield, which is used for thermal enhanced oil recovery (EOR).

4.1.9 Pakistan

- Owing to daily electricity shortages, Pakistan is in need of more reliable power sources. Even though a number of LNG and coal projects in the pipeline will help address these shortages in the short term, there is room for renewable energy penetration in the future. The renewable energy landscape in the country looks positive after numerous projects were announced last year.
- A 100 MW solar PV plant being developed at Quaid-e-Azam Solar Park by Turkish firm Zorlu Enerji Holding is expected to be completed by the first half of 2018. The firm has set a rate of 6 US\$ cents per kWh for the electricity to be produced by the solar plant. A further 200MW has been awarded to the firm for planning and development after the completion of the initial 100 MW of solar.
- Pakistani firm Gharo Solar Pvt Ltd is seeking approval to develop a 50-MWp solar project in Sindh province. The company has already applied for a generation license with Pakistan's National Electric Power Regulatory Authority (NEPRA). The proposed plant is expected to be commissioned in June 2019 and will generate power for local utility K-Electric.
- Scatec Solar and Nizam Energy are planning to develop three 50 MW projects in the Sindh region to supply power to the Central Power Purchasing Agency.
- Letters of intent (LoI) for 19 projects outside the Quaid-e-Azam Solar Park, totaling a capacity
 of 460 MW, have also been issued. Current LoI holders would continue the development of
 their projects under the FiT regime; however, any new projects being developed will have to
 enter the market via an auction scheme.
- The World Bank is working with the Pakistani government to launch the Pakistan Solar and Renewable Energy Programme (PSREP). The International Bank for Reconstruction and Development is considering providing US\$ 200 million and the Green Climate Fund will provide US\$ 100 million for this project. The objective is to increase the installed generation capacity of and enhance the development of renewable energy in Pakistan.

4.1.10 Qatar

- Qatar is looking to meet 20 percent of its electricity demand through solar energy by 2030.
- Qatar Solar Technologies (QSTec) set up the country's first state-of-the-art polysilicon production plant in Ras Laffan Industrial City, 80 km north of Doha. The plant, which commenced operations in March 2017, is producing 8,000 tons of polysilicon per annum.
- A 200 MW solar power plant will be developed in Qatar by Siraj Power. The company has a capital base of \$500 million. Completion of the facility is expected in 2020, and capacity expansion to 500 MW is expected in the future.







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4.1.11 Saudi Arabia

- Saudi Arabia is continuing its push from the previous year to achieve a more decarbonized economy. If the country is hoping to achieve 9.5 GW of renewable energy capacity by 2023 (this includes a target of 3.4 GW by 2020), it must move fast with the development of large-scale projects to meet these targets.
- In October 2017, it announced a US\$500 billion plan to develop an industrial and business zone that will be powered by solar and wind energy. The zone will be located in the northwest of the country and potentially extend to the Egyptian and Jordanian borders. The government is expecting investments of over half a trillion dollars into the zone over the coming years.
- Saudi Arabia's Public Investment Fund (PIF) has signed a Memorandum of Understanding (MoU) with the private equity fund SoftBank Vision Fund for the development of 3 GW solar PV and energy storage projects.
- On February 6, 2018, ACWA Power was selected to develop the 300 MW Sakaka PV project, for a price of 2.36 US\$ cents per kWh. The offtaker, the Saudi Power Procurement Company (SPPC), will soon sign a 25-year PPA with ACWA Power. The Sakaka solar-power project will be the first of many renewable energy projects developed in the country.

4.1.12 Tunisia

- The Tunisian government is looking to increase its renewable energy share to 30 percent of the total energy mix by 2030. In the near term to 2020, the government is looking to install 1 GW of renewable energy capacity.
- Tunisia's Ministry of Energy, Mines and Renewable Energies launched a tender for the deployment of 210 MW of renewable energy power of wind and solar capacity.
 - Through the tender, the ministry aims to allocate 70 MW of solar capacity and 140 MW of wind. Selected projects will sell power to the country's state-owned utility, Société Tunisienne de l'Électricité et du Gaz (STEG), under a long-term PPA.
 - 2. Bids for solar projects were submitted by November 2017. The Tunisian government has estimated that projects selected in the tender will require an aggregate investment of TND400 million (US\$166.7 million).
- In December, STEG issued a tender for a second 10 MW solar plant in Tozeur, while the first solar plant of 10 MW is still under construction by TerniEnergia.
 - 1. The second project is being financed by Kreditanstalt für Wiederaufbau (KfW), a German development bank.
- Project Developer TuNur is planning to build a 4.5 GW concentrated solar park in the Sahara Desert.
 - 1. The project will be located near Réjim Maâtoug in the Kébili Governorate, in the south-west of Tunisia. The aim of the project will be to export power to Italy, Malta and France. If the government approves the project, it could be used to power close to two million homes in Europe.

4.1.13 United Arab Emirates

- The UAE is continuing to take the necessary steps to develop large-scale renewable energy projects, in line with its 2050 energy plan.
- In March 2017, DEWA announced the completion of the 200 MW Phase II of the Mohammad bin Rashid al Maktoum solar park inaugurated by HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of UAE and Ruler of Dubai. The total capacity of the Solar Park is expected to reach 5 GW by 2030.
- Japan's Marubeni and China's JinkoSolar Projects began construction of Abu Dhabi's largest solar plant in May 2017. The consortium submitted the non-weighted bid of 2.94 US\$ cents per kWh (with a power purchase agreement of 25 years with ADWEA) for electricity to be produced by the 1.17 GW Sweihan Solar PV Plant. The plant is expected to be connected to the grid by early 2019.
- DEWA is negotiating a US\$3.9 billion contract to a consortium comprised of Shanghai Electric and Saudi Arabia's ACWA Power to develop and run a 700 MW CSP plant at a tariff of 7.3 US\$ cents per kWh.
- Dubai Electricity & Water Authority (DEWA) also awarded a contract to Etihad Energy Services Company (Etihad ESCO) for the development and installation of floating solar PV systems on the utility's water reservoirs. The company estimates the total installed capacity of the floating solar PV systems expected at to be around 60 MW.
- DEWA also plans to launch a tender for Phase V of the Mohammad bin Rashid Al Maktoum Solar Park. Total capacity is expected to be 300 MW.
- ADEWA is planning to issue an RFP for Sweihan II project with a minimum capacity of 350 MW, but is likely to end up closer to 1.2 GW if the sample template for Sweihan I is used.

4.2 SHIFTING PRIORITIES – SOLAR PEAK POWER

In GCC countries, recent trends highlight a greater increase in peak load as opposed to average or base-load profiles. Persistently low oil and gas export revenues from 2015 until mid-2017 put pressure on utilities and governments to balance their budgets while managing the peak load by adding generation capacity. Building more large-scale conventional power plants puts a burden on government fiscal plans, because those assets have a lower usage factor throughout the year whereas capacity payments are due based on availability and not dispatch of the facility. However, contrary to conventional power plants, solar power plants: (i) are able to meet peak demand loads during the day, (ii) receive energy-based payments only, and (iii) can be built in record time.

IPP models are becoming standard for solar-power plants across the region, with PPAs increasing in sophistication to capture more value from installations. Solar-power plants offer an optimal fit for utilities relating to variable generation profiles throughout the day. It is expected that large-scale solar PV in the Middle East will remain competitive with conventional power generation. These economics will continue to boost the adoption of solar in countries such as Egypt, Jordan, Morocco and Pakistan.

PHOTOGRAPHER GHADIR SHAAR

UTILITY SCALE 5. SP PROJECTS

AT THE END OF 2017, CLOSE TO 5 GW OF CSP PROJECTS WERE IN OPERATIONS WORLDWIDE.

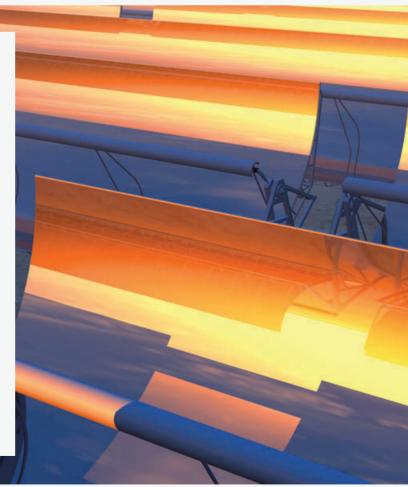
2016 saw a big boost for CSP when China announced its target to have 1.4 GW of CSP capacity at a FiT of &1.15 per kWh (17 US\$ cents per kWh). Most of this capacity is expected to come online in the course of 2018. For projects commissioned after 2018, the FiT is expected to be reduced substantially.

Tariffs for CSP vary a lot from country to country. It is difficult to compare tariffs, because the underlying inputs tend to vary greatly, e.g. irradiance levels, peak vs. off-peak incentives, concessional vs. commercial financing, tax breaks, cost of land, etc.

In 2017, all eyes were focused on DEWA's Phase IV CSP project. Saudi Arabia's ACWA Power and its EPC partner, Shanghai Electric, are in negotiations with DEWA to secure this 700 MW opportunity at a tariff of 7.3 US\$ cents per kWh. The project will use a combination of parabolic trough and tower technology.

One of the projects up for tender in 2018 is MASEN's 800 MW Noor Midelt solar hybrid project in Morocco. Contracts for the 800 MW Noor Midelt project will be awarded by the end of 2018. Technical offers were submitted in December 2017 by three consortia: Engie / Nareva, EDF Energies Nouvelles / Masdar, and ACWA Power. Commercial offers are expected to be submitted around June 2018.

It is possible that Saudi Arabia's REPDO will announce a solar CSP project as part of its renewable program. Timing, size and technology are yet to be announced, if confirmed.



ROOFTOP 6. PROJECTS

Rooftop solar kicked off in the UAE in 2017 with approximately 4 MW connected at the start of the year, with about 20 MWp connected by December 2017. It is expected the rooftop market in the UAE could top 60–70 MW in 2018, resulting in triple-digit growth in a one-year period.

The main drivers for this segment are government entities, and commercial and industrial (C&I) segments. Pure play residential rooftop remains negligible in the UAE with a very slow uptake from individuals.

MESIA expects to see the following trends in 2018 for the rooftop segment:





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1. Significant volume uptake in the C&I segment:

After the initial build of some high profile clients such as Majid al Futtaim and Aramex, we expect to see a very strong uptake in the commercial and industrial segment as others follow suit with increased confidence to execute their pending plans for going solar either over lease or EPC models.

2. Increased pressure on EPC and lease margins:

Due to an increased number of entrants, 2017 saw an increase in competition and a rise in PV panel prices in 2017. We expect the margin for financiers as well as EPCs to come under pressure. The market is very price sensitive and seems willing to take risks where pricing is concerned, with clients not fully educated yet on evaluating reasonable yields.

3. Shortage of skilled resources:

There was limited local expertise, but through the increased competition, this has come under additional strain with qualified individuals moving between companies. Experienced resources are scarce and are to be imported, while young graduates are plentiful but not experienced.

4. Increase in local manufacturing and stocking of components:

As the market heats up, clients expect faster execution times. This will force manufacturers to consider forward stocking points, will drive local wholesale distribution and underpin local fabrication of panels, structures and cables.

5. Increased regulation from authorities:

As solar systems become more dominant and as demand grows, we expect the authorities to pay closer attention to health, safety and environment (HSE), fire safety and grid-interaction issues. This may also lead to a segmentation of the solar providers differentiating the experts from the start-ups.

6. Growth of robotics and attention to operation and maintenance (O&M):

Large commercial roofs are costly to maintain on a manual cleaning regime. This will spark innovation as the industry tries to optimize the operations cost and yield.

7. Increased litigations against missed performances:

The factors of temperature, dust and other deratings are often underestimated to close the sale. This leads to dissatisfied clients being confronted with less return on their investment than expected.

8. Growth in BIPV and solar carports:

The marginal cost of building solar on façades and parking structures makes for a very solid business case while also bringing significant marketing mileage. We expect these segments to see a strong uptake in 2018.

9. Small-scale distributed generation initiatives:

Regulation, like net metering, or deployment targets, as defined in Dubai's new Solar Shams program, which makes solar mandatory for all rooftops in 2030, will push distributed solar-power generation ... eventually. Jordan has been advancing small-scale distributed PV in 2016, where we have seen RFPs from universities, libraries, etc. The uptake of this may be slower in the UAE, but we believe a market will start in 2018 in Oman and Saudi Arabia for this segment.

SOLAR OUTLOOK REPORT 2018

There is still work to be done on the regulatory side in most markets, especially in simplifying regulation and lowering the soft costs for adopting solar. For rooftop solar to take substantial market share, we will need to see government regulators do their part and adopt policies that promote solar energy.

Regional financiers need to be further educated on innovative and sustainable ways of financing rooftop solar as this is currently almost exclusively done on an equity basis. The first steps have been taken, but more work remains. The launch of the Dubai Green Deal initiative could change the landscape on this, however a launch date for this program is not yet known.

Rooftop solar is proving to be an important contributor to the energy demand with consumers large and small being more exposed to the benefits, both financial and environmental.

Cost of electricity generation from renewables has always been the key factor, especially in the competition between rooftop solar compared to subsidized conventional gas-based energy sources. As these subsidies are liberalized, rooftop solar will become an increasingly attractive proposition.

As more news on deployed and commissioned projects is being published in the region, the original hesitant approach towards solar rooftops will change and the demand will increase.

The challenge to educate the customer became easier in 2017.

Looking forward, the market demand is set for double-digit growth that can allow for a conservative 60 MWp market to take place in 2018 in the UAE.

It is worth mentioning that Abu Dhabi started to roll out their net-metering program at the start of 2017, with the first projects reaching completion in 2018.

6.1.1 Bahrain

- The National Energy Efficiency Plan (NEEAP) and NREAP were reviewing the potential for a net metering scheme that could help boost the rooftop solar market. The net-metering policy was detailed at the Solar Utilities Network forum on February 7, 2018, in Bahrain.
- In summary, it can be stated that the train has left the station and a new phase in the market has started. We are looking forward to an exciting and very sunny 2018.

6.1.2 Dubai

DEWA's net-metering policy has been quite a landmark, and has now made industrial and commercial-scale solar rooftop projects feasible for building owners and investors.

We must mention the increasing take-offs in the implementation of rooftop solar-energy schemes in the Middle East. Recently, a number of very large rooftop solar plants have been announced in Dubai, which include:

- Etihad ESCO announcement of > 60 MWp rooftop tender
- DP World, installing the region's largest distributed project of +20 MWp with over 51 rooftops and four car parks
- Unilever and Nestle solar lease executed by ALEC Energy and Yellow Door Energy
- ALEC Energy is in execution of 6.4 MWp for Nabooda and 6.5 MW rooftop plant for Emaar on the new Dubai Hills Mall
- Mall of the Emirates 2MWp executed by Alsa Solar Systems with 4 more MW pending in MAF group in UAE
- The Dubai solar schools program
- Big brands like Aramex, ABB, Pepsi, and the AI Tayer group have also announced rooftop plans

Additionally, rooftop solar creates new business opportunities, including:

- Wholesale solar component business
- · Localization of component manufacturing like structures, cables and panels
- There are now over 70 companies registered as contractors and consultants in the Dubai emirate
- · Training opportunities for established electrical and mechanical contractors

The growth in the rooftop market is driven by a couple of factors:

- · Continued push for sustainable solutions of which PV can be considered the exemplar
- Economies of scale ramping up very fast, creating incredible price drops
- Innovation and efficiencies that will prepare ourselves for the next wave of systems rollouts

The main catalyst is the continued drop in system price. We expect that module prices will fall back from their Q3 2017 heights as more suppliers are exerting commercial pressure on the main suppliers and as more project volume flows into our region.

As the industry is reaching maturity, the increased activity in the research and development segment can be noticed by innovation in monitoring, inverters and PV cell technology.

- While the 'plain vanilla' polysilicon PV panels keep on seeing a slow and steady increase in efficiencies, there are also new technologies announcing the next breakthrough. The strong growth of Mono-PERC and segmentation to modules with characteristics for optimized use in desert conditions are a case in point.
- On the inverter side, we see launches of high-capacity string inverters that can reduce the remainder of the Bill of Material (BOM) Costs and speed up installation times.

The key element of operations and maintenance in our region is the need for regular cleaning of the panels so that they can deliver the power they are designed for. As solar plants are not energy dense, it means a vast expanse of space is needed to build them. The surface cleaning of the panels can take quite some time and bring specific particularities. Access to the site, access to water, HSE issues, working at height and in the heat are all considerations that need to be made before planning out a PV system.

The losses an owner faces on a PV system in the UAE are higher (approximately 50 percent more) than the system losses faced by a solar system owner in, say, Germany. However, the inflow of energy into a UAE-based system is also double that of the energy that hits the surface in Germany, under the condition that the panels are clean.

These facts should not deter owners from building solar as a proper approach in facility management can easily secure the big benefits that solar can bring. Innovation is also moving very fast in this segment and it will not be long before solar-powered robotic cleaning will become the norm in terms of how solar is maintained in the Middle East. Many solutions are being developed and experimented with but have not yet reached large-scale adoption. We still see manual cleaning as the run-of-the-mill solution, which is being offered due to low labor rates for systems under 1 MWp, but as the industry grows and large rooftops get populated, it cannot be imagined that manual cleaning, with all its associated risks, will be the way forward.

6.1.3 Jordan

Jordan has an attractive net-metering scheme for rooftop projects. Electricity rates can be very high, so this encourages consumers to seek alternative power sources:

- NEPCO (National Electric Power Company) is required to buy electricity from renewable energy generators
- Net-metered systems currently total around 100 MW
- For schools, universities and other institutions, net metering could help pay off the investments in a short amount of time (even in two years). In partnership with all stakeholders, the Jordan Renewable Energy & Energy Efficiency Fund (JREEEF) has developed a royal initiative that aims to cover around 2,600 schools with solar rooftops during the coming years

The Jordanian market can be considered a mature market and is reaching saturation.

6.1.4 Egypt

In August 2017, the upper limit of a net-metering installation was increased from 500 kW to 20 MW.

- For the first time, electricity consumers connected to the grid were allowed to install net-metering systems directly.
- The cost for net-metered electricity in 2017/2018 was around 0.714 Egyptian Pounds (4 US cents) per kWh.
- Owners of PV systems of up to 500 kW do not need to apply for a net-metering license from the regulator.
- Owners can enter into contracts directly with the offtaker.
- 50 MW of installations are expected in 2018 through green funds and grants.

6.1.5 Morocco

Masdar successfully completed the installation of an off-grid power project for 19,438 homes in over 1,000 rural villages. The project was developed through a partnership between Masdar and Morocco's Office National de l'Electricité et de l'Eau Potable (ONEE) with the aim of electrifying remote, off-grid communities that lack adequate energy supply.

6.1.6 Oman

Oman launched the 'Sahim' scheme to promote small-scale renewable energy projects (e.g. rooftop):

- The program was launched in May, 2017
- · Few large-scale rooftop and parking projects are under execution, helping the promotion of solar
- We could see 1,000-5,000 rooftop projects completed within the coming years

Consumers will be able to sell power back to grid at the prevailing tariff:

• Benefits to consumers could then vary, depending on the price at the time of export

6.1.7 Pakistan

On January 3, 2018, Pakistan officially launched changes to its already existing net-metering guidelines, which were implemented in 2015. The process is being revamped to make it easier for the consumer to get the necessary permissions to connect their systems.

The Government of Punjab is looking to install solar PV rooftop systems on all 2,400 basic health units, 20,000 schools and public buildings in the province.

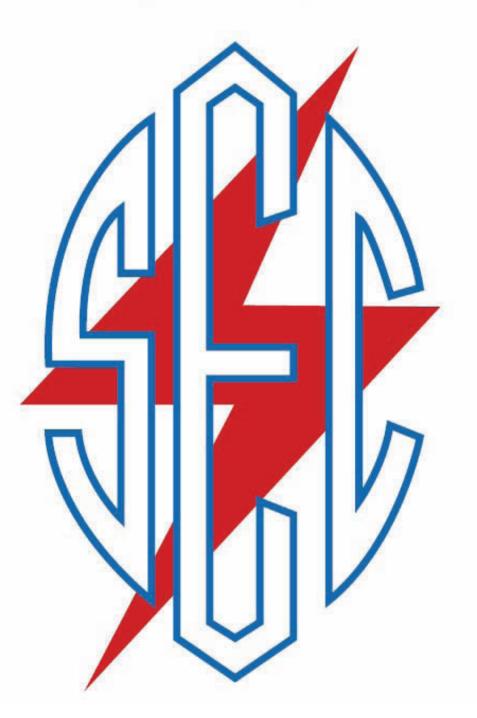
The Pakistani Government is also expecting around 2 GW worth of connections to become net metered in the future.

6.1.8 Saudi Arabia

Saudi Arabia's Electricity and Cogeneration Regulatory Authority (ECRA) has prepared a draft of the rooftop solar program:

- Expected to launch in July 2018
- Applies to systems smaller than 2 MW
- Local content regulations were announced
- Electricity rates will steadily increase further supporting the market

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ENERGY 7.STORAGE

As renewable-energy technologies continue to add increased pressure on national grids, energy storage and demand response systems are necessary to help balance these additional loads. The global storage market is projected to grow by 20 GW per year post 2025. As countries in the MENA region attempt to meet their ambitious renewable-energy goals, the need for storage solutions will become more of a necessity rather than an option.

Integrating storage technologies in the market, especially on a large scale, might be a slow process due to the price as well as design and implementation. However, the market outlook is still positive as items such as batteries, pumped hydro, molten salt, gravity storage and compressed air are implemented into more projects.

Gravity storage, an emerging technology, may also be considered as an answer for these types of projects throughout the region. This process uses the lifting of a very large rock mass using water pumps. The rock grabs the energy, which can be released when the water that is under pressure is discharged back through a turbine.

An alternative solution for smaller-scale commercial and industrial projects is hybrid systems. These systems, which combine solar PV, diesel generators and batteries to store power, can reduce industrial loads to help reduce the strain on commonly used diesel generators. This has been successfully deployed in the world's largest PV-diesel hybrid power plant located in Cobija, Bolivia. This PV system has a capacity of 5.2 MW, and the battery storage unit has a capacity of 2.2 MW. With the system in place, about half of Cobija's energy demand is now covered by clean power.

In order to enable a seamless integration of battery storage solutions, a few things should be taken into consideration:

Defining grid services required:

Whilst in capacity markets, such as the UK, Germany, USA and Australia, batteries can make more economic sense due to the larger extent of services provided – i.e. energy arbitrage, enhanced / fast frequency response (EFR /FFR) and other ancillary services – in the Middle East the main applications will be for renewable integration, especially in Dubai, Abu Dhabi and Jordan, where solar power is already being deployed. In the case of renewable integration, the main services would be time shifting, capacity firming and reducing curtailments. Batteries can also perform other services in the grid as required.

Value stacking:

The more services performed by the battery, the better the end cost per kWh. In order to subsidize the tariff, the battery should be allowed to perform multiple services to multiple users will be more cost-effective if allowed to perform in both transmission and distribution systems.

Regulatory framework:

In order to capture benefits of value stacking, there must be a framework in place that allows the battery to act as an independent grid actor, reflected in the transmission and distribution codes. Such frameworks should also regulate the compensation mechanisms.

Procurement models: Depending on the use case, there are multiple ownership models for storage. Using the battery for different applications makes this somewhat complex:

- 1. Independent supplier model: Similar to an IPP, developer contracts owns and operates a project, which the offtaker contracts for a fixed capacity payment and a variable O&M charge following the operating mode of the battery.
- 2. Utility owned: The main offtaker / operator owns and operates the battery with the aim of supporting the system as a whole. This offers more flexibility, especially when the range of services is wide and includes transmission and distribution level applications.

7.1.1 Dubai

DEWA recently signed an MoA with the GCC Interconnection Authority (GCCIA) and the Belgian Dredging, Environmental & Marine Engineering Group (DEME). The agreement will study the possibility of a 400 MW pumped hydro-storage station with a capacity of 2,500 MWh of storage. This project follows DEWA's launch of the 250 MW pumped storage innovation in Hatta, where water will be stored in the Hatta Dam and in an upper reservoir that will be built into the mountain. Solar energy produced during the day will be used to pump water from the lower reservoir to the upper reservoir. During the evening peak, the speed of the waterfall from the upper reservoir will be used to generate electricity through use of hydroelectric turbines. Even though pumped storage is the most common form of electricity storage currently, its applications in countries within the MENA region (besides the UAE) are limited if the necessary geological formations are not present and if the acquisition of adequate funding is an issue.

7.1.2 Jordan

Towards the end of 2017, Jordan's Ministry of Energy and Mineral Resources (MEMR) released an Expression of Interest (EOI) for developers interested in a 30 MW/ 60 MWh electrical storage project. In January 2018, 23 groups were prequalified. The project, designated Phase 1, will be developed at Ma'an Development Area No. 1 and will be connected to the existing substation. The project is expected to be completed in April 2019. An additional Phase 2 tender may be released to bring investment for Ma'an Development Area No. 2.

The Al Badiya company, a subsidiary of Philadelphia Solar in Jordan, signed a PPA with Irbid District Electricity Company (IDECO) to implement a 12 MWh lithium-ion battery at the 12 MW solar plant in Al –Mafraq. Once commissioned, the battery will become the largest in the Middle East. The project has begun construction and is expected to be commissioned around August 2018.



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DIGITAL 8. SOLAR

Digitization has become more prevalent in the power industry, which could help manage the grid as thousands, if not millions, of new generation points (also known as prosumers) are added to the system.

Over the past year, buzz words such as Blockchain, cryptocurrencies and Bitcoin have dominated news headlines that don't always make a clear distinction between them. There have been numerous debates about how Blockchain technology could penetrate and disrupt different commercial ecosystems. Although most of the conversations center on the price volatility of the cryptocurrencies using Blockchain technology, much less attention has been paid to the technological infrastructure behind cryptocurrencies, namely the Blockchain technology itself.

Blockchain was originally created for use in the cryptocurrency Bitcoin, as its public transaction ledger. It is essentially a shared ledger consisting of a group of records or transactions that are packed into blocks and chain-linked chronologically. The technology is considered secure because blocks are verified and are difficult to alter. Blockchain is now being explored as a way to decentralize how energy is distributed within communities.

In April 2016, LO3 Energy and Siemens collaborated to create a pilot microgrid project in New York in which residents with solar panels had the ability to sell excess energy to their neighbors using Blockchain technology.

This allowed residents within the community to choose green alternatives to meet energy needs. It also provided a system based on a peer-to-peer model, which could be useful in emergency situations, such as a natural disaster. Decentralized microgrids with battery storage could help customers gain access to stored electricity temporarily in the event of a blackout. MIDDLE EAST SOLAR INDUSTRY ASSOCIATION

ALTHOUGH THE BROOKLYN MICROGRID IS A SMALL EXAMPLE OF HOW THE PEER-TO-PEER ELECTRICITY SHARING MODEL WORKS, THIS TECHNOLOGY COULD PROVE USEFUL FOR DIFFERENT COMMUNITIES AROUND THE WORLD.

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ELECTRIC 9. VEHICLES

Global EVRT opened the first public charging station in Oman at the Crowne Plaza Hotel in Sohar, during the Middle East Electric Vehicle Road Trip 2018.

Photographer: Danie Duverger.



9.1 OUR THIRD ATTEMPT AT ADOPTION

Electric vehicles (EVs) were actually the first type of automobile to have been invented, dating back to the 1800s. By the early 1900s, electric cars were in their heyday, comprising one third of vehicles on the road. They continued to show strong sales up until their fall in the market, largely due to Henry Ford's introduction of the highly celebrated Ford Model T – a commercial breakthrough that quickly priced out EV alternatives. The global EV program then slumped and there was very little advancement for decades to come.

It was only in the 1970s that the EV concept started gaining ground again. This time it was due to soaring global energy prices following the 1973 oil crisis. Industrial countries sought action to decrease reliance on oil to curb associated risk. As an example, the US Congress passed the Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976, authorizing the energy department to support research and development in electric and hybrid vehicles. Nevertheless, this second attempt still did not allow for EVs to adequately rival their gasoline-powered counterparts. Issues relating to performance, range and reliability were a setback for this resurgence – EV technology has not yet matured enough to allow them to be considered a sound transportation alternative. Again, global interest in EVs has taken a back seat in favor of already-existing technologies.

Twenty years later, the concept of EVs resurfaced and California was at the center of this development. The passage of the 1990 Clean Air Act Amendment and the 1992 Energy Policy Act in the US – plus new transportation emissions regulations issued by the California Air Resources Board – helped create a renewed interest in EVs in the United States. Nordic countries also pioneered regulations to entice their markets as a sustainable alternative to gasoline-powered vehicles.

Sales of battery electric vehicles and plug-in hybrid electric vehicles passed 2 million units in 2016 according to International Energy Agency. Even though the sales growth for EVs in 2016 was 40 percent, the growth outlook for EVs still remains positive. EV representation of total passenger and light-duty vehicle volumes sold in 2015 sat at 0.69 percent of global automotive retail. While this number could seem negligible, it is a 10-fold increase over EV retail volume in 2005. Looking at the ongoing trend of EV penetration globally, one would be confident that its market share is set to rise.

9.2 KEY EVENTS PROPELLING THE EV MARKET

There have been other key events that have led to the revival of EVs as a transportation alternative.

Event 1:

The launch of the Toyota Prius in Japan as the first mass-produced hybrid EV in 1997 and its global release in 2000.

Event 2:

The announcement that a Silicon Valley start-up is gearing up to produce luxury EVs that could range up to 350 kilometers on a single charge. An initial loan of US\$465 million from the Department of Energy to Tesla Motors quickly positioned this new player as the largest auto industry employer in California and a global contender to socialize EV adoption.

Event 3:

Battery range has always been the most limiting factor for EVs. Recent developments have addressed this, while research and development is looking to make this a moot point altogether. For example, the new model of the Renault Zoe, released in November 2016 at the Paris Motor Show, more than doubled the mileage of its immediate predecessor; this vehicle now has a range of 400 km. Teslas, by virtue of their larger batteries, always had higher ranges in comparison with the competition; recently they began releasing models with 100 kWh batteries that can reach ranges of 500 km and beyond.

EV technology and its supporting infrastructure, like charging stations, have advanced by great leaps and bounds over the past few years. Our analysis of global trends, production patterns and an impending imperative set by global warming indicates that EVs will continue to make strong progress in the short-term and potentially dominate the automobile industry in the long-term. We believe that this will be reflected both in global markets and in the Middle East.

We believe that solar power, combined with different types of storage technology and green mobility through EVs, will be the cornerstones of any modern city in the foreseeable future.



9.3 EV ELECTRICITY CONSUMPTION

The current estimated consumption of EVs sits at around 2,500 kWh per annum for a vehicle being driven 25,000 km over a 12-month period. In 2016, the global EV power consumption was estimated at 6,000 GWh of electricity annually according to Bloomberg New Energy Finance. Inevitably, there is a lot of merit in considering EVs a potentially substantial customer for electricity production.

With ever-increasing choice between EVs and more auto manufacturers committing to providing sustainable options for their customers, we believe that the UAE could be one of the best places in the world for early electric vehicle adoption, given the average travel distances involved, excellent electrical infrastructure and high quality of roads.

9.4 THE CASE FOR THE UAE

The UAE is very well placed to embrace EVs:

9.4.1 Geographical structure

The geographical structure of the seven emirates result in only small distances needing to be covered. The Emirates Electric Vehicle Road Trip (EVRT), for example, traveled throughout the countries on a route covering less than 800 km. With the range of EVs increasing year on year, we project that 'range anxiety', as it is often poorly termed, will become a notion of the past. In fact, the majority of new electric vehicles being launched into the market have a minimum of 300 km, with some holding a range of around 520 km.

Even an occasional 'long drive' weekend trip to Fujairah or Hatta, a slightly longer distance, can be covered confidently in an electric vehicle. This is because there have been electric vehicle charging stations built in locations across the UAE and Oman. Through the Emirates EVRT, charging stations were built by Engie at various AccorHotels in Ras Al Khaimah, Fujairah, Abu Dhabi Al Ain, Sohar, Musannah, and Muscat. This is in addition to the 100-odd charging stations that already exist in Dubai. Check Plug Share to view all of the charging stations in the UAE and across the Middle East. The UAE is by far the leader in charging station numbers and this continues to grow.

9.4.2 Charge from home and power your home

Even without charging stations, it gives EV owners great comfort to know that they can plug their car into any socket and charge their vehicle even though it takes more time than at the charging station.

Globally, 80 percent of electric car charging happens at home. This is one of the biggest benefits of owning an EV: convenience. Going forward, it is believed that charging station infrastructure will mainly serve to supplement range for extremely long drives or in case of emergency.

The future of EVs could even be able to power (part of) your home through use of the electric vehicle's battery.

9.4.3 A nation of innovators, early adopters and car-lovers

The UAE is a frontrunner when it comes to innovation and implementing both strategies and regulation to facilitate the adoption of renewable initiatives.

There is a strong willingness from the government to support reduced emissions and to innovate in areas such as autonomous driving. For instance, the Dubai Autonomous Transportation Strategy aims to transform 25 percent of transportation to autonomous by 2030.

In addition, the Dubai Supreme Council of Energy launched a range of initiatives to support electric vehicles owners, including free charging, free parking, free registration fees and free Salik tags.

With an abundance of solar energy in the UAE, electric vehicles can be supplied by low-cost and clean electricity. The electricity supply in the UAE is highly reliable and affordable and will be increasingly powered by renewable energy – a winning combination for sustainable transport.

The UAE is also a nation of car-lovers who are ready to purchase the latest vehicle that provides comfort, thrill, style and convenience. This early adoption strategy is likely to lead to EVs becoming more and more affordable in the long run.

9.5 THE CASE FOR MENA

The Nordic countries pioneered driving EV demand artificially by introducing regulation to speed adoption. In Norway, all electric-powered vehicles are exempt from non-recurring vehicle fees, including purchase taxes, road tax, public parking fees and toll payments, as well as being able to use public bus lanes.

The above placed Norway as the global leader in percentage penetration of EVs. The following is an overview of the take rate by market (2016) :

Norway	29%
Netherlands	6.4%
Sweden	3.4%
China	~1.5%
France	~1.5%
UK	~1.5%

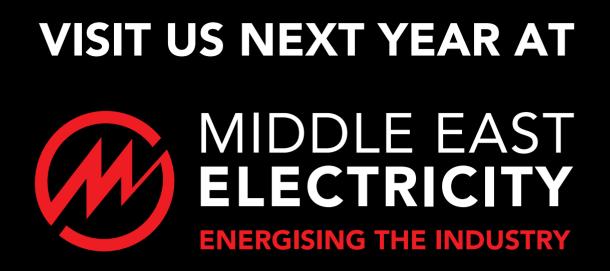
Source: International Energy Agency

These countries share one common theme in popularizing EVs: they have introduced market incentives to support having this technology as a viable transportation option.

In the MENA region, a multitude of policies and initiatives have started to take shape in the past couple of years – these include Jordan's Royal Court adoption of EVs as the technology-of-choice, the Jordanian Government's MoU with Tesla, BMW and Renault to support the development of suitable EV infrastructure in the country, Dubai's Clean Energy Strategy 2050 and Saudi Arabia's Vision 2030.

These initiatives will certainly feed into disrupting the status quo, creating more demand for EVs on the roads. However, it will be only following translating governments' vision papers and strategy documents into tangible policies that we will see a radical shift in EV penetration in the region. It is important to note that electric vehicles are only as green as the source where the energy was produced. This places solar produced electricity as a viable option to translate a government's emission targets into an everyday reality.





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CONCLUSION

2018 announces itself as the year for massive roll-out of solar energy in the MENA region. Saudi Arabia and UAE will continue leading the industry in the GCC, with expected tenders for more than 3 GW of solar PV in Saudi Arabia, more than 1.5 GW of solar PV in the UAE, and 1 CSP project to reach financial close in Dubai in the course of 2018. We will see more large-scale projects popping up across the entire MENA region (e.g. Jordan, Kuwait, Morocco and Qatar). Large-scale solar remains pretty much on-track.

As far as rooftop solar is concerned, there is still some work to be done on the regulatory side in most markets. Most notably, for rooftop solar to take substantial market share, we will need to see government regulators do their part and adopt policies that promote solar energy, e.g. through net-metering schemes. Regional financiers and bankers need to be further educated on innovative and sustainable ways of financing rooftop solar. The first steps are taken, but more work remains to be done.

Just like in 2017, we expect to see further adoption of storage solutions (e.g. batteries, pumped hydro, etc.) across the Middle East. Storage and demand-response solutions provide additional flexibility to the transmission system and curb peak load. 2018 will be a record year for solar and its associated technologies in MENA through:

- A high number of tenders announced for large scale solar;
- Plenty of opportunities for distributed solar in the C&I and rooftop solar segment;
- Further adoption of EVs and green mobility;
- First of a kind opportunities for storage using different storage technologies; and
- Potential new regulatory frameworks for wheeling and energy management.

We are confident there will be plenty of opportunities for all of our MESIA members and look forward to reporting to you on our collective success in the 2019 edition of MESIA's Solar Outlook Report.

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GLOSSARY OF 11 TERMS

ADWEA	Abu Dhabi Water & Electricity Authority
ADWEC	Abu Dhabi Water & Electricity Company
AFDB	African Development Bank
BIPV	Building Integrated Photovoltaic
ВОМ	Bill of Material
BOO	Build, Own and Operate
C&I	Commercial & Industrial
CAGR	Cumulative Annual Growth Rate
CSP	Concentrated Solar Power
DABS	Da Afghanistan Breshna Sherkat
DEME	Dredging, Environmental & Marine Engineering Group
DEWA	Dubai Electricity and Water Authority
EBRD	European Bank for Reconstruction and Development
ECRA	Electricity and Cogeneration Regulatory Authority
EETC	Egyptian Electricity Transmission Company
EOI	Expression of Interest
EOR	Enhanced Oil Recovery
EPC	Engineering, Procurement & Construction
ESCO	Etihad Energy Services Company
EV	Electric Vehicle
EVRT	Electric Vehicle Road Trip
EWA	Electricity and Water Authority
FIT	Feed-in Tariff
GCC	Gulf Cooperation Council
GCCIA	Gulf Cooperation Council Interconnection Authority
GECOL	General Electricity Company of Libya

GW	Gigawatt
HEC	High Economic Council
HSE	Health, Safety and Environment
IDECO	Irbid District Electricity Company
IFC	International Financing Corporation
IPP	Independent Power Project
ISCC	Integrated Solar Combined Cycle
IWP	Independent Water Project
JREEEF	Jordan Renewable Energy & Energy Efficiency Fund
KFW	Kreditanstalt für Wiederaufbau
КИРС	Kuwait National Petroleum Company
LCOE	Levelized Cost of Electricity
LNG	Liquefied Natural Gas
MASEN	Moroccan Agency for Solar Energy
MEMR	Jordan's Ministry of Energy and Mineral Resources
MENA	Middle East and North Africa
MW	Megawatt
NEEAP	National Energy Efficiency Plan
NEPCO	National Electric Power Company
NEPRA	National Electric Power Regulatory Authority
NREA	New and Renewable Energy Authority
NREAP	the National Renewable Energy Action Plan
0&M	Operation and Maintenance
ONEE	Office National de l'Electricité et de l'Eau Potable
OPWP	Oman Power and Water Procurement Company
PDO	Petroleum Development Oman
РРА	Power Purchase Agreement
PSREP	Pakistan Solar and Renewable Energy Programme
PV	Photovoltaics
REPDO	Renewable Energy Project Development Office
RFP	Request for Proposal
RFQ	Request for Qualification
SPPC	Saudi Power Procurement Company
STEG	Société Tunisienne de l'Électricité et du Gaz
USAID	United States Agency for International Development



