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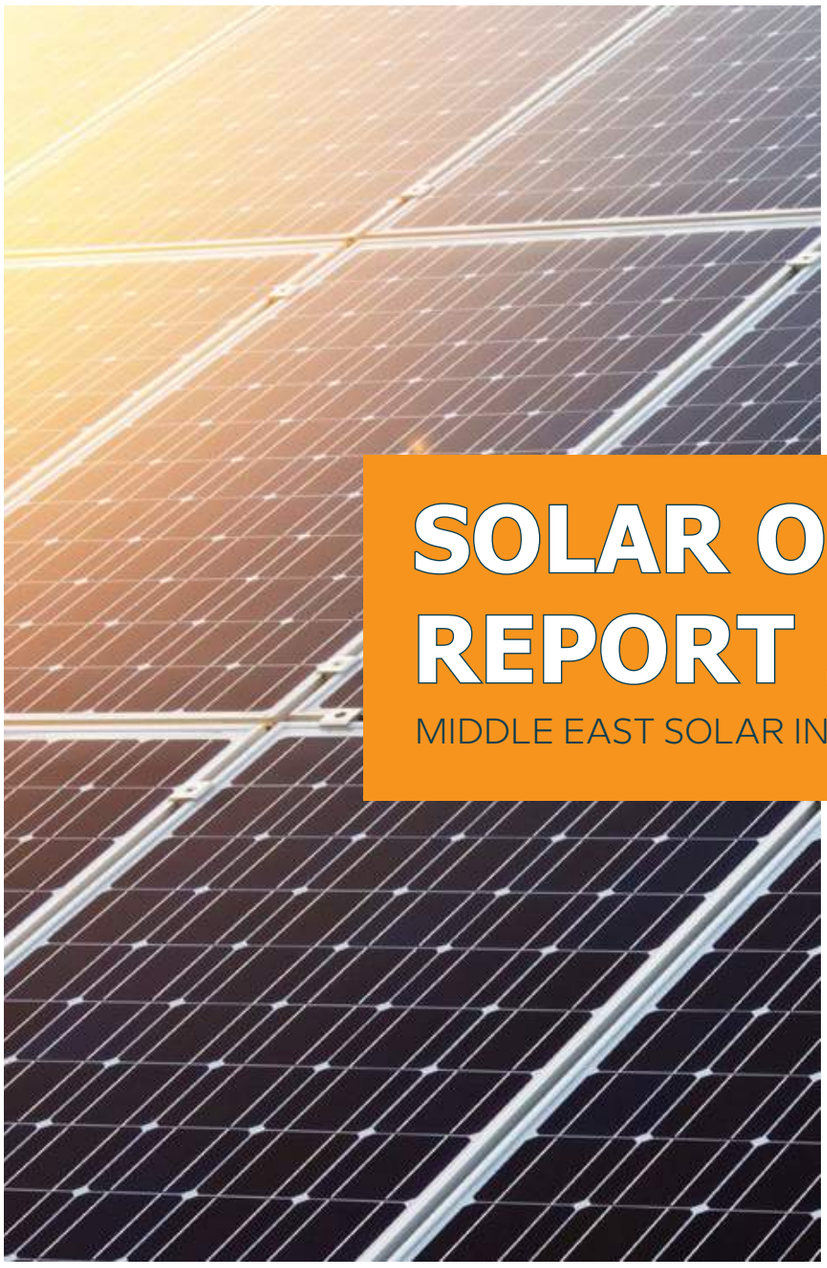

SOLAR OUTLOOK REPORT 2017

MIDDLE EAST SOLAR INDUSTRY ASSOCIATION

Prepared by
prominent **MESIA**
member companies

February **2017**

Knowledge Partner

FROST & SULLIVAN

For Solar Middle East

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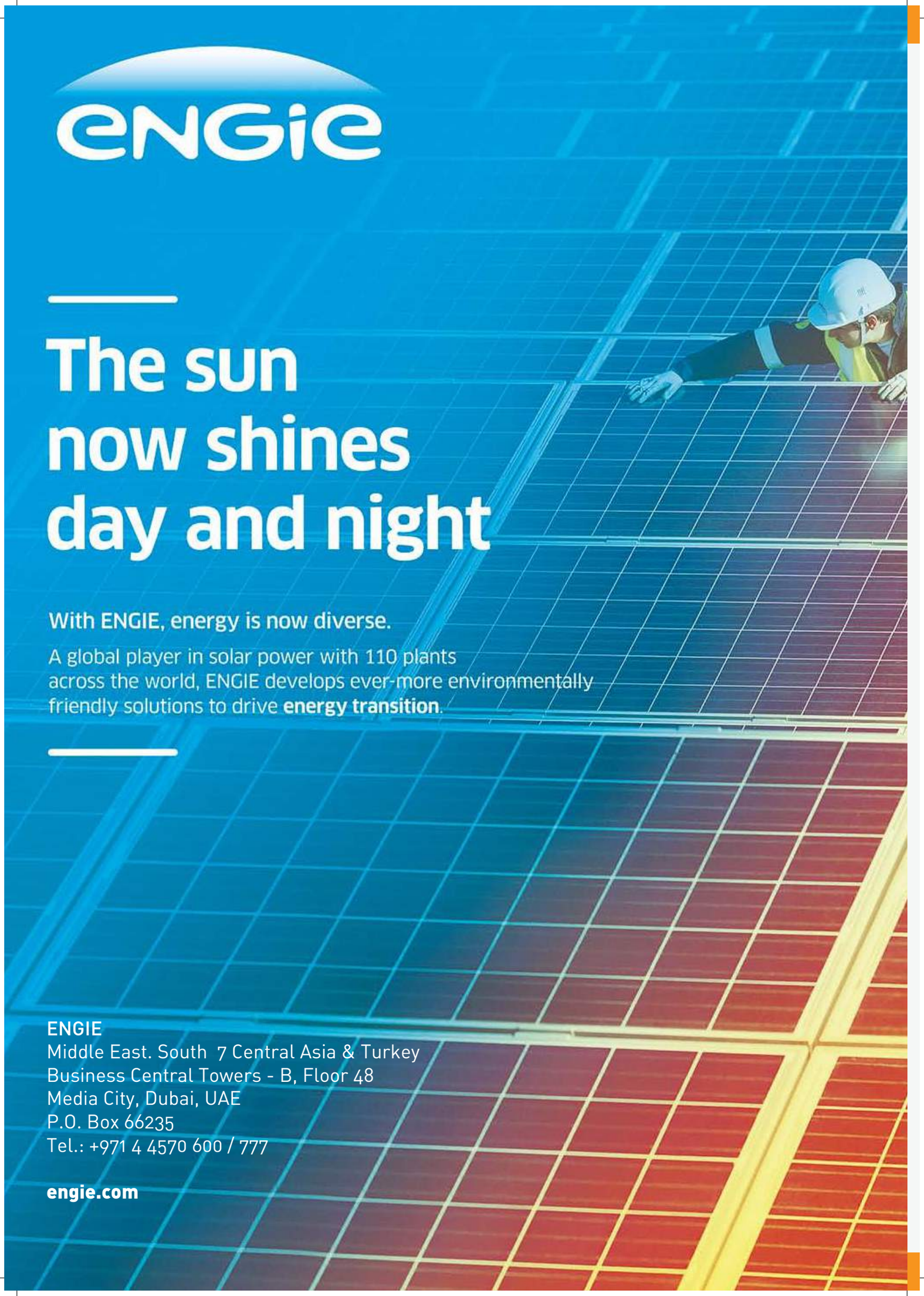
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1. INTRODUCTION

2016 WAS A RECORD BREAKING YEAR FOR SOLAR IN THE MIDDLE EAST.

With record low tariffs on Dubai Electricity and Water Authority's (DEWA) 800 MW Phase III project and Abu Dhabi Water and Electricity Authority's (ADWEA) Sweihan project, we could call it a successful year for large scale solar on the Arabian Peninsula. Record low tariffs below 3 US$ cents per kWh attracted worldwide press attention.

At 2.99 US$ cents per kWh, the contract for DEWA's phase III awarded by DEWA to Masdar was the world's lowest unsubsidized solar power price in the first half of 2016. It was not a one-off occurrence. By September 2016, we witnessed another world record low tariff in Abu Dhabi with a new record-low levelized cost of electricity (LCOE) for large scale solar power at 2.42 US$ cents per kWh.

These low prices have changed the perception of policymakers and industry leaders. It even led to a downward revision of the Feed-in tariff in Egypt and revives the debate of the usefulness of Feed-in tariffs versus competitive bidding in the MENA region. On an unsubsidized basis, solar PV without storage is now one of the cheapest sources of electricity available – it costs less than unsubsidized nuclear, LNG, and diesel used for off-grid power. Based on IRENA's projections, solar PV LCOEs are expected to continue to decrease going forward, but whether it will continue to drop as rapidly is subject to debate.

Rooftop solar kicked off in the UAE with approximately 6 MW up and running by the end of 2016. It is expected the rooftop market in the UAE could reach 70 MW in 2017. This would mean more than tenfold growth in a 1-year period.

During COP22, the Middle East and North African countries announced initiatives and increased targets to combat climate change by reducing gas emissions while increasing resilience of the local eco-systems. Saudi Arabia, Morocco and Tunisia put forward ambitious targets to curb the impact of climate change.

The world record tariffs provided solar with an important jump-start of more large scale solar projects in the Middle East in 2016 (e.g. Saudi Arabia, Kuwait, and Jordan) and will drive even more large-scale project announcements and executions in 2017 in other countries (e.g. Oman and Tunisia). This will also be supported by market price reforms for natural gas and subsidy adjustments in net energy exporting countries in the GCC, which have just led to dramatic energy price hikes in a number of countries in the Middle East in the course of 2016. Despite the increase in oil prices by 40% at the end of 2016 compared to January 2016, this trend is unlikely to be reversed. Increasing demand for electricity, drinking water and cooling in an environment that more and more recognizes the value of sustainable clean energy will accelerate further solar penetration in the Middle East for both centralized and distributed power plants and also have a wider impact on solar thermal power in industrial applications.

Going forward, centralized and decentralized battery storage applications combined with solar PV are expected to compete in the foreseeable future head to head with solar thermal power.

For MESIA's 2017 Solar Outlook Report, we kept our traditional sections and added a few new ones, which we believe could be helpful to assess the solar market potential in the MENA region.

In what follows, we would like to provide you with MESIA's view - with the support of our members - on key solar markets in 2017. We hope you will enjoy the reading.

WIM ALEN

General Secretary MESIA
On behalf of the
MESIA Board

2. SOLAR TRENDS IN 2017

IN 2017, WE WILL OBSERVE THE FOLLOWING SOLAR DRIVERS AND TRENDS IN THE MENA REGION:

1. Start of construction of mega-PV plants:

after the award of DEWA's Phase III project and the bid for ADWEA's Sweihan project, 2017 will be characterized by the start of the implementation of these two landmark projects in the Middle East. Table 1 provides the latest update of solar projects (PV, CSP, and ISCC) across the MENA region in operations, under execution or under tender in December 2016.

Table 1: Solar (PV, CSP, ISCC) Installation overview:

SOLAR (PV and CSP) INSTALLATION OVERVIEW (MWac) [1]			
COUNTRY	**OPERATIONAL**	**UNDER EXECUTION [2]**	**UNDER TENDER**
ALGERIA	382		
EGYPT	76	1,500	
JORDAN	77	540	
KUWAIT	12	50	
MOROCCO	180	520	
SAUDI ARABIA	23		100
UAE	135	1,000	1,200
TOTAL	**885**	**3,610**	**1,300**

Source: Middle East Solar Industry Association (MESIA) – Solar Outlook Report 2017

[1] Centralized and distributed solar
[2] PPA signed, awarded, construction, commissioning, etc.

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At the end of 2015, 693 MW of solar capacity was operational. One year later, about 200 MW was added to the installed base. By April 1, an additional 200 MW will come online.

2. Decreased cost for solar equipment:

MESIA expects solar equipment prices to further decrease: (a) solar panels prices are expected to drop further in 2017, (b) 1,500 volt inverters become market standard, widely adopted, and thus cheaper, and (c) further consolidation on the balance of plant will drive costs further down through economies of scale.

3. Increased cost of debt for new projects:

infrastructure and more particularly renewable projects, including solar PV and CSP benefitted largely from the low cost of funding environment resulting from quantitative easing initiatives. With quantitative easing being scaled back and interest rates on the rise, renewable energy tariffs will be affected more than conventional tariffs in the absence of a fuel component.

4. Very low LCOE offers across Middle East and North Africa:

we will continue to see solar Independent Power Projects (IPP) bids and Engineering, Procurement and Construction (EPC) contracts with very low LCOEs in 2017. The reality of such aggressive pricing strategies is to be put to the test in terms of who will reach the lowest tariffs in Saudi Arabia, Jordan, Oman, and Kuwait.

5. Low oil and gas prices:

consistently low to medium oil and gas prices will not slow down solar growth in the GCC; it is rather the opposite. Due to dramatically reduced income from oil sales, Saudi Arabia announced a hike in gasoline, diesel, and natural gas and electricity prices for consumers, which will improve solar power's competitiveness.

6. Energy independency:

with solar PV LCOEs still below current market prices for oil and LNG and at par with natural gas based power generation, net energy importing countries, like Jordan, Morocco, and Pakistan will keep driving growth for large-scale solar power plants.

7. Pick-up in battery storage solutions:

solar PV without storage is at grid parity; so far solar PV's main utility is to act as a fuel-saver. Solar PV without storage does not allow to save on capacity payments payable to conventional power plants. The importance of reliable base load power from solar resources is highlighted by the increased importance of storage on a number of projects: CSP, or hybrid (CSP+PV) solutions across the region.

8. Growth in commercial & industrial rooftop solar:

lower prices for solar and increasing electricity rates will further lead to the adoption of distributed solar in 2017, mainly rooftop. One important driver for this market will be financial institutions becoming more comfortable to provide long term financing for industrial and commercial rooftops. We see the market further picking up in Jordan, Kuwait, Palestine, Pakistan, and the UAE.

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. Jordan has been advancing small scale distributed PV in 2016. We have seen RFPs from universities, libraries, etc.

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3. SOLAR PROJECTS IN 2017

GHADIR SHAAR

Table 2: PV pipeline 2017

PROJECT	COUNTRY	MWAC	STATUS	CLIENT
SWEIHAN	UAE	1,200	AWARD	ADWEA
NOOR MIDELT [3]	MOROCCO	450	BID STAGE	MASEN
TO BE CONFIRMED	TUNISIA	100	PLANNING	TO BE CONFIRMED
FIT – ROUND 2	EGYPT	1,500	AWARD	NREA
OPWP – 200 MW	OMAN	200	PLANNING	OPWP
JORDAN – ROUND 3	JORDAN	200	EXPRESSION OF INTEREST	NEPCO
AL JOUF & RAFHA	SAUDI ARABIA	100	BID STAGE	SEC
SAKAKA	SAUDI ARABIA	300	ANNOUNCED	SEC
AL-DIBDIBAH	KUWAIT	2,450 GWH	EXPRESSION OF INTEREST	KNPC
TOTAL		**> 4,050**		

Source: Middle East Solar Industry Association (MESIA) – Solar Outlook Report 2017

Table 3: CSP pipeline 2017

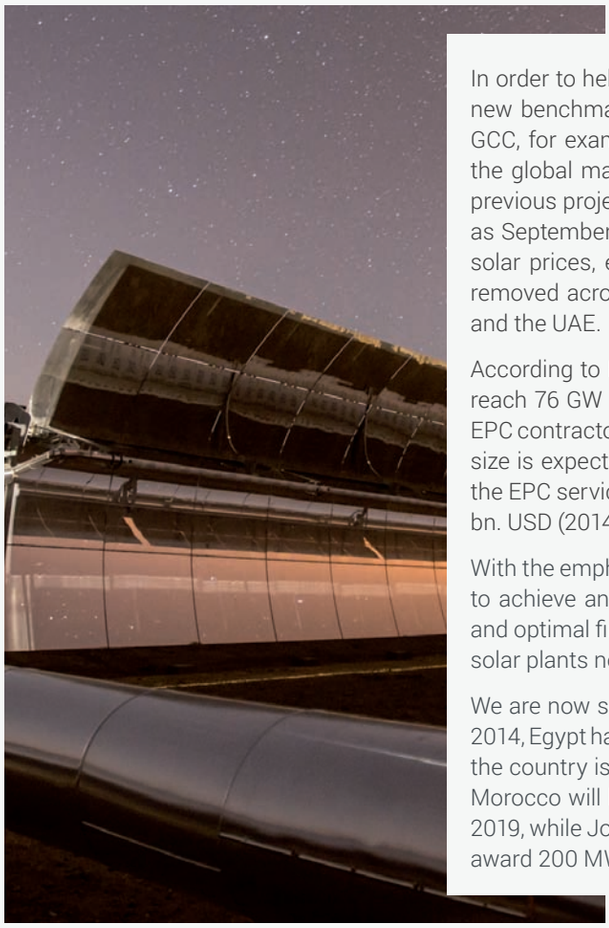
PROJECT	COUNTRY			
NOOR MIDELT [4]	MOROCCO	450	BID STAGE	MASEN
TAQA CSP	EGYPT	250	PLANNING	TAQA ARABIA
WEST NILE CSP	EGYPT	100	PLANNING	TO BE CONFIRMED
YAZD ISCC	IRAN	17	BID STAGE	IPDC
AL ABDALIYAH ISCC	KUWAIT	60	BID STAGE	MEW
ZTA CSP	LEBANON	3	PLANNING	TO BE CONFIRMED
LEBANON CSP	LEBANON	50	ANNOUNCED	TO BE CONFIRMED
TAIBA ISCC	SAUDI ARABIA	180	PLANNING	SEC
DEWA CSP	UAE	200	BID STAGE	DEWA
TOTAL				

Source: Middle East Solar Industry Association (MESIA) – Solar Outlook Report 2017

[3] Hybrid plant PV + CSP
[4] Hybrid plant PV + CSP

4. LARGE SCALE PV PROJECTS

ELECTRICITY DEMAND IN THE MIDDLE EAST HAS HISTORICALLY BEEN GROWING BETWEEN 7% AND 8% CAGR. IN 2017, TOTAL ELECTRICAL ENERGY DEMAND IN THE MIDDLE EASTERN REGION IS EXPECTED TO EXCEED 1,000 TWH.



ACWA POWER, NOOR 1 CSP IPP PROJECT, OUARZAZATE, MOROCCO

In order to help satisfy this thirst for energy, the Middle East has been setting new benchmarks in terms of adopting large-scale solar power plants. In the GCC, for example, DEWA achieved 2.99 US$ cents per kWh at a point when the global market average was around 7-8 US$ cents per kWh with DEWA's previous project setting a previous world record at 5.85 US$ cents as recently as September 2014. The region's energy market will be affected by these low solar prices, even more as fuel and electricity subsidies will be increasingly removed across the region in countries such as Kuwait, Saudi Arabia, Oman and the UAE.

According to Frost & Sullivan, the GCC installed solar capacity is expected to reach 76 GW by 2020. This represents a massive opportunity for developers, EPC contractors, equipment suppliers, and financiers. The solar module market size is expected to range between 6.3 and 7.5 bn. USD (2014-2020), whereas the EPC services market for solar PV is expected to range between 2.5 and 3.0 bn. USD (2014-2020).

With the emphasis on large-scale power plants in the region driven by the need to achieve an ideal balance between a plant's size, EPC economies of scale and optimal financing terms, utilities in the region are adopting more and more solar plants not only in the hundreds of megawatts, but now in the gigawatts.

We are now seeing a rapid adoption of large-scale solar in the Middle East: 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 about 500 MW of CSP and 600 MW of PV in operation by 2019, while Jordan has 540 MW of PV projects under construction and is set to award 200 MW (4x50 MW) in the course of 2017.

4.1 HIGHLIGHTS IN MENA'S LEADING SOLAR PV MARKETS

This overview includes an outline of the biggest solar markets in the Middle East in 2017; countries are listed based on the projected solar market size for the current year.

4.1.1 United Arab Emirates

- The UAE has established itself as a key solar market over the past couple of years and will continue to show leadership in 2017, in particular in Dubai with the start of construction of Phase III and in Abu Dhabi with the award of Sweihan.
- The Clean Energy Strategy 2050, launched by HH Sheikh Mohammed bin Rashid Al Maktoum, Vice President and Prime Minister of the UAE and Ruler of Dubai, foresees to provide 7% of Dubai's total power output from clean energy sources by 2020, 25% by 2030, and 75% by 2050.
- After a landmark PPA of only 5.85 US$ cents per kWh was signed in 2014 for the second phase of the Mohammed bin Rashid Al Maktoum Solar Park, 2016 saw Phase III awarded with 800 MW for delivery over three phases until 2020 at 2.99 US$ cents per kWh. The final size of the park in 2030 was also upped from 1 GW originally to 3 GW in early 2015, and to 5 GW by the end of 2015. Based on the latter figure, the solar park will be the largest of its kind in the world.
- The Abu Dhabi Water and Electricity Authority (ADWEA) has tendered out its first utility scale PV project: a minimum 350 MW Sweihan solar power plant that was tendered in 2016. Given the evaluation formula in the tender documents, bidders were encouraged to maximize the utilization of the site and offer proposals with higher capacity. As per the bid read-out information, bidders submitted indeed proposals with capacities of above 1 GW.
- In 2017, DEWA is expected to tender a 200 MW solar thermal project based on molten salt tower technology. The bid submission date is expected to be scheduled in May 2017. Hence, the award and closing will happen in the second half of 2017. DEWA has made it no secret that it is looking for a tariff below 8 US$ cent per kWh, which would set another world record for solar thermal power. DEWA intends indeed to build the largest CSP fleet in the world, using the IPP model and the 200 MW will be the first of several such CSP projects. It is expected to be operational by April 2021. DEWA targets to generate 1,000 MW using this technology by 2030 in the Mohammed bin Rashid Al Maktoum Solar Park.

4.1.2 Saudi Arabia

- Increasing electricity demand is burdening the Saudi government, as generating more power means burning more fossil fuel. The peak load is a key issue here, driving up the cost of electricity generation during the summer way beyond 15 US$ cents for generating assets with low capacity factors.
- Saudi Arabia's most significant aim is to reduce its dependency on fossil fuels and create a holistic and organized plan to incorporate solar energy. Saudi Arabia needs to find the right balance between reducing the consumption of fossil fuels for power generation and maintaining relatively low electricity costs for the end user.
- SEC is currently tendering a 100 MW PV project across two sites in the northern region of the Kingdom: Al Jouf (80 MW) and Rafha (20 MW). In mid-2018, we will see the first large scale solar PV project in operation in Saudi Arabia.
- The Ministry of Energy has recently announced a target of 9.5 GW of renewables in the Kingdom by 2023. 300 MW is expected to be tendered later this year. We labeled it as the Sakaka project. Later rounds will also include CSP. All projects will be tendered as IPPs.

4.1.3 Oman

- Oman Power and Water Procurement Company SAOC (OPWP), 7-year statement mentions that OPWP expects solar energy projects, wind farms, and potentially other renewable energy projects to complement gas-fired generation in the Sultanate in the near future.
- The RFP for first utility scale PV projects is expected to be launched by the tendering authority in mid-2017. The project size will be around 200 MW.

4.1.4 Pakistan

- Pakistan remains in the midst of a power crisis witnessing electricity shortfalls that are projected to grow to ~7 GW, representing around 32% of the country's total generating capacity. The socio-economic costs of the resulting blackouts demand the urgent introduction of new generation capacity. Though hydropower has been the only renewable energy resource of note in the past, solar PV and wind offer promising solutions for fast-track capacity additions that are increasingly cost-competitive. Decision makers have taken stock of the situation and are encouraging implementation of solar PV on both large and small scales.
- Large-scale solar PV development in the country has been set in motion with the completion of the initial 100 MW phase of the 1 GW Quaid-e-Azam Solar Park (QASP) in Punjab in the summer of 2015. Construction of the second phase of the project – installing 300 MW – is currently underway. The projects are developed via direct proposals and result in long-term PPAs, remunerated through feed-in tariffs set by the regulator. Letters of intent for an additional 400 MW have also been issued for projects outside the solar park.

4.1.5 Morocco

- As over 90% of Morocco's energy is imported and originates from fossil fuels. For many years now, the country has been looking into and investing in cheaper, domestic, cleaner solutions. By 2020, the country aims to increase its renewable power generation capacity to 42%, up from 31% in 2013. The Moroccan Agency for Solar Energy (Masen), which has been entrusted with developing and implementing the Moroccan Solar Plan, is targeting a minimum capacity of 2 GW of CSP and PV by 2020.
- Masen is currently establishing a solar power complex in Ouarzazate that will include both CSP and PV systems. The first two phases of the project combine three CSP power plants totaling 510 MW, each including storage. The first one, NOOR I, a 160 MW parabolic trough system, was completed in January 2016. Construction of the other two – NOOR II, a 200 MW parabolic trough system, and NOOR III, a 150 MW central receiver tower – started last year and are scheduled to be completed in 2017.
- Masen has also launched a dedicated IPP-based PV program, NOOR IV (PV). The first phase was awarded at a tariff of around 4.8 US$ cents per kWh.
- Masen has also launched a new IPP-based hybrid CSP-PV program, which is called NOOR Midelt. The project consists of the development of a hybrid CSP-PV plant of 450 MW.

4.1.6 Egypt

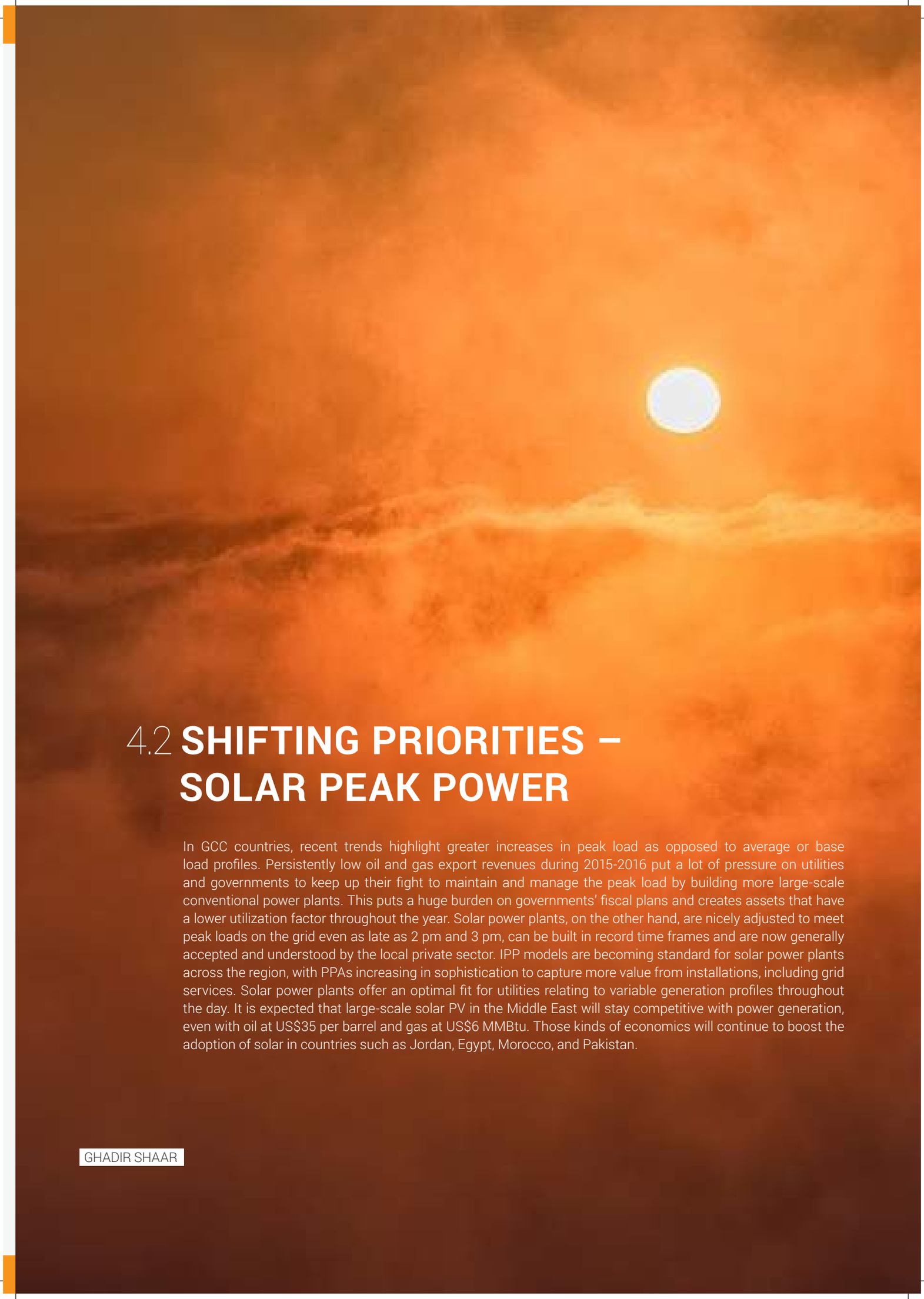
- As Egypt is increasingly struggling to satisfy its rising power demands with domestic oil and gas, it plans to raise its share of renewable energy capacity to 20% by 2022.
- In 2014, Egypt announced an ambitious renewable FIT program to tap its solar and wind resources. It targets 2.3 GW of solar capacity by 2017, of which 2 GW will be centralized PV power plants and 300 MW will be distributed PV installations under 500 kW.
- The first solar tender was strongly oversubscribed. After initial delays, and a reduced feed-in tariff (from 14.34 to 8.40 US$ cents per kWh), the program is now moving forward with a smaller number of developers. The land at the project sites in Benban/Aswan and Zafarana is allocated to awarded bidders and serious developers who need to reach financial completion of their projects before the FIT expires. MESIA expects close to 1,500 MW of projects to reach financial close in 2017.
- Multilateral financial institutions such as IFC, EBRD and OPIC are all geared up to fund these projects and allocated resources to ensure the success of the program.
- In summer 2015, the Egyptian Electricity Transmission Company (EETC) and the New and Renewable Energy Authority (NREA) announced tenders for 200 MW of PV and 50 MW of CSP in the West Nile region. These projects have now been delayed. The latest news is that the 200 MW project is delayed to July 2017.

4.1.7 Kuwait

- First utility scale PV plant started operations in Kuwait in 2016: 10 MW Sidrah 500 plant, located at the Umm Gudair oil field, which is owned by a Kuwait Petroleum Corporation subsidiary, the Kuwait Oil Company.
- The Al Abdaliyah ISCC (60 MW is to be generated from CSP) has been postponed a few times. A new bid date remains to be announced.
- K-Companies intend to select developers for 1-4 PV power plants to generate 2,450 GWh/year.
- Kuwait targets to generate 15% of the country's electricity from renewable sources by 2030.

4.1.8 Jordan

- Unlike its neighbors, Jordan has hardly any energy resources; its power generation relies almost completely on crude oil and gas imports in a very unstable region. Recently, Jordan has been looking at increasing its share of renewables to 10% by 2020, which includes a goal of reaching 600 MW of solar PV.
- In Jordan's second 200 MW direct proposal solar tender, the Ministry of Energy and Mineral Resources (MEMR) announced four winners in May 2015. Three of the four winning PV bidders, each providing 50 MW, had offered power prices of around 6 US$ cents per kWh.
- Masdar: 200 MW PV project, PPA signed with NEPCO in October 2016.
- After the European Investment Bank (EIB) and the French Development Agency have approved financing, Jordan will be able to increase its power transmission capabilities via the so-called Green Corridor project. Phase 1 will bring 650 MW of transmission capacity in 2018, while Phase 2 will add 1,500 MW of transmission capacity by 2020.
- Net metering and power wheeling schemes have been very helpful in expanding small distributed solar systems in Jordan. In 2016, we will see around 80 MW of power wheeling projects coming online and over 50 MW of net metering systems connected to the distribution grid. Given the high solar yield and steep electricity tariffs for large customers, we can expect further projects in net metering and net metering with wheeling, especially in the commercial and industrial electricity consumer market segment.
- During MESIA's trade mission in November this year, the launch of round three (i.e. a 200 MW (4x50 MW) solar project tender under a direct proposal-scheme) was officially announced.



4.2 SHIFTING PRIORITIES – SOLAR PEAK POWER

In GCC countries, recent trends highlight greater increases in peak load as opposed to average or base load profiles. Persistently low oil and gas export revenues during 2015-2016 put a lot of pressure on utilities and governments to keep up their fight to maintain and manage the peak load by building more large-scale conventional power plants. This puts a huge burden on governments' fiscal plans and creates assets that have a lower utilization factor throughout the year. Solar power plants, on the other hand, are nicely adjusted to meet peak loads on the grid even as late as 2 pm and 3 pm, can be built in record time frames and are now generally accepted and understood by the local private sector. IPP models are becoming standard for solar power plants across the region, with PPAs increasing in sophistication to capture more value from installations, including grid services. 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 stay competitive with power generation, even with oil at US$35 per barrel and gas at US$6 MMBtu. Those kinds of economics will continue to boost the adoption of solar in countries such as Jordan, Egypt, Morocco, and Pakistan.

GHADIR SHAAR

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5. ROOFTOP PROJECTS

OVER THE LAST FEW DECADES, GULF COUNTRIES HAVE SEEN RAPID ECONOMIC GROWTH AND HAVE BECOME MAJOR ENERGY CONSUMERS.

GHADIR SHAAR

Regional electricity consumption is growing between 7% and 8% per year - meaning generating capacity has to be doubled every decade. Gulf countries will require 100 GW of additional power over the next 10 years to meet their demand.

In the early phases of the Middle Eastern solar market, the emphasis has been on large-scale power plants as a quicker means to stop the financial bleed for net energy importers, and help lower the average cost of generation, sustain value for long-term resources and optimize generation assets in net energy exporting countries. At the same time, the value of distributed solar PV is well understood and remains the right tool for job creation across the value chain, technology localization and as a means to address loads right at the point of consumption, while also aiding in the postponement of investments in transmission upgrades and centralized generation. Examples, such as Shams Dubai, which kicked off in 2015, will continue to grow in 2017, and other countries such as Kuwait, Jordan and Egypt will see their own distributed solar programs taking further shape in 2017. It is worth noting that aside from Egypt, which issued a limited FIT for rooftop PV systems, net metering schemes seem to be the preferred model for commercial and industrial rooftop solar within the GCC. This is driven by the fact that small-scale solar PV saw a drop of 50% in cost just within the last 3 years or so, enabling net metering models for certain consumption profiles of residential and industrial entities across the region.

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

5.1 HIGHLIGHTS IN MENA'S LEADING SOLAR ROOFTOP MARKETS

5.1.1 Dubai

2016 saw very attractive pricing for solar panels. This trend is expected to continue in 2017 representing the best possible scenario for solar PV. Therefore, the challenge is to gain the customer's confidence and convincing him to invest in rooftop solar plants. With more and more solar projects deployed and commissioned in the region, the perspective on solar rooftops will change and demand will further increase.

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 can't fail but to notice increasing trends in the implementation of roof top solar energy schemes in the Middle East. Recently, a number of very large rooftop solar plants have been announced in Dubai which include:

- A 1.5 MW system deployed to Jebel Ali Power Station
- The Dubai solar schools programme, targeting around 50 MW over three years of systems installed in schools across the Emirate
- DP World, installing the region's largest distributed system over 51 rooftops and 4 car parks
- Al Nabooda Automobiles have signed a solar lease for the development of 6.7 MW of solar power to their new DIC facility
- Aramex new 3 MW system on their logistics facility
- Additionally, rooftop solar creates new business opportunities, including:
- Component manufacturers, panels, invertors, combiners, measuring and monitoring systems, EPC contractors, electrical and mechanical contractors
- Both local and international solar developers and financiers looking for good investment returns.

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A team of researchers from MIT and the Masdar Institute of Science and Technology has developed a new solar cell that combines two different layers of sunlight-absorbing material to harvest a broader range of the sun's energy. Such layered, or "multi-junction", solar cells are typically expensive to manufacture, but the researchers used a novel, low-cost manufacturing process for their step cell. The team's step-cell concept can reach theoretical efficiencies above 40 percent and estimated practical efficiencies of 35 percent.

If we step back and take a bird's eye view on the current momentum of today's solar energy industry and business markets, it strikes us with awe at how this specific industry is humbly picking up speed, crunching pricing/tariff records, alongside the fast-paced R&D of producing cheaper, lighter and more efficient solar panels. Only within the last 5 years, did we witness how the cost of a solar panel has fallen to around 80% of what it used to be.

We're seeing now not just CPV (Concentrated Photo Voltaic) but also BIPV (Building Integrated Photovoltaics) panels and modules that enables architects and building owners to 'tango' to a certain extent their building design's aesthetics alongside capturing the sun's energy.

As of now, roughly speaking only 20% to 25% of all buildings are strong enough, or well oriented enough to have sun facing roof top mounted solar systems.

5.1.2 Ras Al Khaimah

In January 2017, the Government of Ras Al Khaimah announced in the World Future Energy Summit that it intends to launch a solar rooftop program with an aggregate maximum capacity of 50 MW.

The program will be implemented based on a BOO/BOOT model. The solar PV panels will be installed on the rooftops of 25 – 30 sites primarily consisting of industrial and commercial buildings, and owned by RAK government and private entities. The Investment and Development office, in Ras Al Khaimah ("IDO") is spearheading this program.

It is expected that the relevant local legislation, regulating the legal and practical framework of this program will also be adopted to set out the parameters of the rooftop program in Ras Al Khaimah. This program will mark the first solar rooftop project in Ras Al Khaimah and is aimed at attracting world class developers.

5.1.3 Jordan

In Jordan, a country with very limited and expensive energy resources, roof top solar schemes have been implemented on a massive kingdom-wide scale. Mosques, churches, schools, even stand-alone bank facilities have installed solar panels on the roof. Some roof top solar thermal applications have even been in place since the 70s, specifically for water heating applications.

5.1.4 Kuwait

In Kuwait a recent study estimated the expected power to be generated from installing Solar PV Systems on the roofs of almost all government buildings to exceed 750 MWp.

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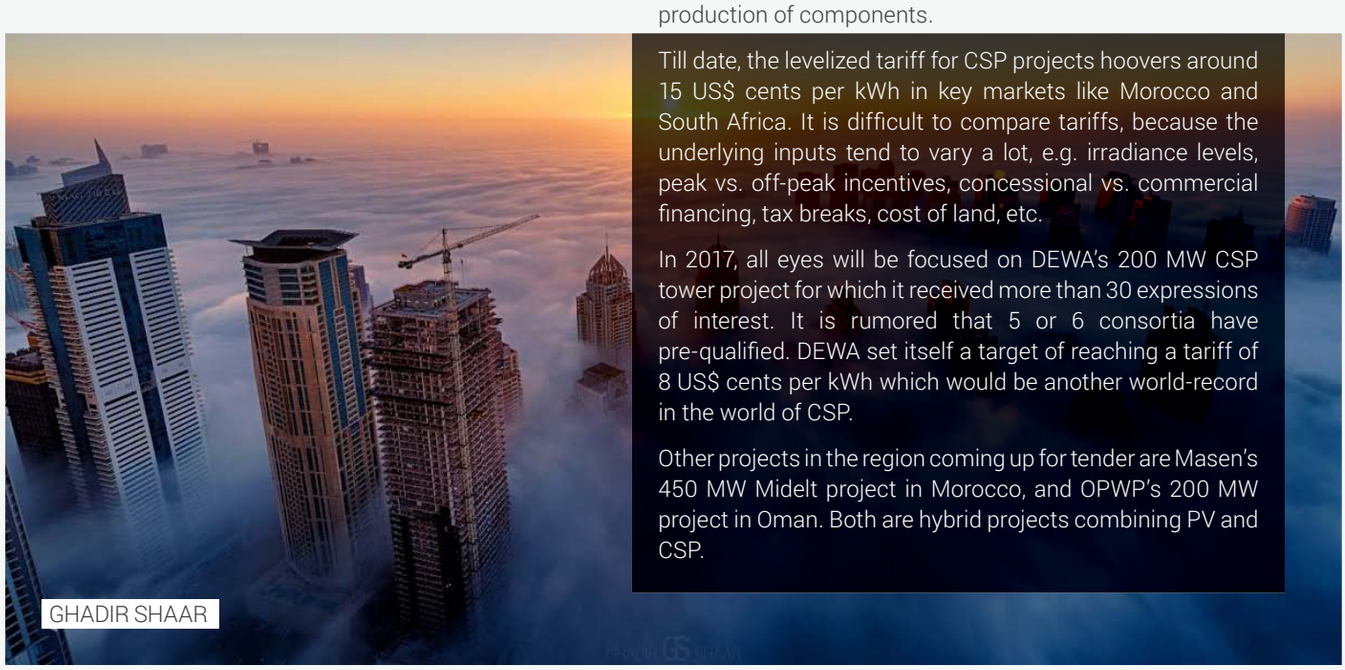
UTILITY SCALE
6. CSP PROJECTS

AT THE END OF 2016, CLOSE TO 5 GW OF CONCENTRATED SOLAR POWER (CSP) PROJECTS WERE EITHER IN OPERATIONS OR CONSTRUCTION WORLDWIDE.

The projects are located in a number of key countries along the solar belt: Spain, Morocco, South Africa, United States, India, and Chile. Morocco's NOOR I project reached commercial operation date in January 2016.

2016 saw a big boost for CSP when China announced its target to have 1.4 GW of CSP capacity online by 2018. China's National Development and Reform Commission set the feed-in tariff (FIT) policy for the CSP demonstration projects is 1.15 per kWh (equivalent to 17 US$ cents per kWh). Local governments are allowed to take multiple measures such as tax breaks, subsidies, green credit, and grant preferential land rights to support the fast track development of the industry. For projects commissioned after 2018, the FIT is expected to be reduced substantially. The expectations from China's CSP program are high, in the sense that significant cost reductions are expected from accelerating the learning curve, standardization, and mass production of components.



GHADIR SHAAR

Till date, the levelized tariff for CSP projects hoovers around 15 US$ cents per kWh in key markets like Morocco and South Africa. It is difficult to compare tariffs, because the underlying inputs tend to vary a lot, e.g. irradiance levels, peak vs. off-peak incentives, concessional vs. commercial financing, tax breaks, cost of land, etc.

In 2017, all eyes will be focused on DEWA's 200 MW CSP tower project for which it received more than 30 expressions of interest. It is rumored that 5 or 6 consortia have pre-qualified. DEWA set itself a target of reaching a tariff of 8 US$ cents per kWh which would be another world-record in the world of CSP.

Other projects in the region coming up for tender are Masen's 450 MW Midelt project in Morocco, and OPWP's 200 MW project in Oman. Both are hybrid projects combining PV and CSP.

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Supported by a proven track record and true Middle Eastern presence, the company's achievements place it among the most reliable solar companies in Jordan and the Middle East.

Izzat Marji Group has built its reputation by deploying solar plants with performances that exceed customer expectations, transforming solar energy into green assets by maximizing benefit and being independent in electricity supply. The company is able to effectively manage all phases of the solar development cycle, from market and site identification to the grid connection and subsequent plant operation.

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7. ENERGY STORAGE AND DEMAND RESPONSE

As the renewable energy's share on the grid increases there is a clear need to ensure full utilization of renewable energy and to balance the grid. Energy storage and demand response are key to increase the renewable energy penetration. Energy storage e.g. by pumped hydro has been in use for long time while battery storage is gaining acceptance.

7.1 ENERGY STORAGE

Storing energy can be done in many different ways: e.g. batteries, flywheels, molten salt, pumped hydro, etc. DEWA envisages the implementation of a 200 MW pump storage innovation in Hatta. This will be a new trend in the solar industry in the Middle East. Pumped storage is already successfully used in other parts of the world to store the excess electricity produced by e.g. renewable/nuclear plants during the night for use during daytime peak-hours. In DEWA's case, 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. The efficiency of the power station will reach 90% with response to demand for energy within 90 seconds. It is expected that other utilities across the MENA region will start looking at this new technology in the next 2-3 years.

7.2 DEMAND RESPONSE

Demand response refers to voluntary (and compensated) load reduction used as a system reliability resource. Two broad categories of demand response mechanisms are available to power systems:

Price-based demand response programs vary the price of electricity over time to encourage consumers to change their electricity usage patterns. Price-based mechanisms include time-of-use pricing (which assigns prices for consumption during different blocks of time), critical peak pricing (which specifies a very high rate for a limited number of hours), and real-time pricing (which varies rates in response to wholesale market prices, often on an hourly basis).

Incentive- or event-based demand response programs provide financial compensation to customers who allow the program administrators to directly control certain electricity-consuming equipment and/or reduce their electricity demand upon request. Examples of incentive- and event-based mechanisms include demand bidding or buyback programs, emergency demand response programs, capacity markets, and ancillary services markets.

Demand response ensures either reduction in demand from certain flexible consumers at the time of peak demand or conversely increasing the demand when high renewable energy is generated. As all GCC grids face peak consumption during summer period, demand response is an efficient way to incentivize local consumers to shift demand thereby avoiding installation of peaking capacity and need to enhance transmission facilities. As demand response takes time to develop, it has to be initiated now in order to ensure that renewable energy share can be gradually increased in Middle East.

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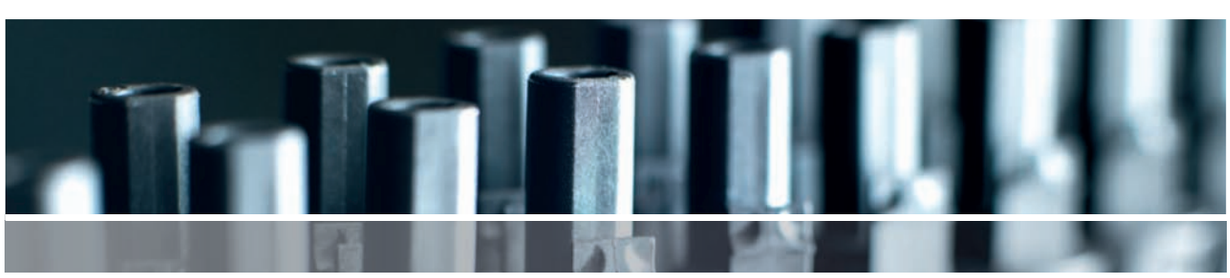

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8 CONCLUSION

2016 was a record-setting year across the MENA region. The year 2017 announces itself as the year for a further roll-out of solar energy in the MENA region. The UAE will continue leading the industry, with the implementation of 2 mega solar PV projects awarded and 1 CSP project up for tender in the first half of 2017 in Dubai. We will see more large scale projects popping up across the entire Middle East, e.g. Jordan, Kuwait, and Saudi Arabia. Large scale solar is pretty much on-track. Indeed, during the World Future Energy Summit in Abu Dhabi in January 2017, Saudi Arabia announced its ambitious plan to have 9.5 GW of renewables commissioned by 2023. The first 300 MW solar is to be expected before the end of 2017. Jordan will tender another 200 MW solar PV, and Kuwait will soon launch the request for prequalification for a large scale solar park at Shagayah.

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.

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 allows to curb peak load.

2017 looks like a promising and busy year for those active in the solar industry.

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