



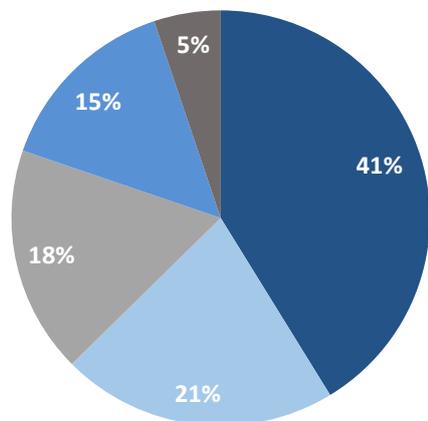
Solar Energy in the UAE: Impressive Progress

The development of the renewable-energy sector in the UAE has been moving ahead rapidly. Enjoying strong government support, solar energy has made particularly impressive progress. The UAE has again received some of the lowest renewable-energy prices awarded globally for both photovoltaic (PV) and concentrated solar power (CSP), highlighting the great resources available in the country and GCC. Many factors are contributing to this early success, with financing playing a critical role in achieving low costs.

The UAE has seen rapidly rising electricity consumption at an annual rate of 5% over the past five years, propelled by strong economic activity, a rising population, and industrialisation. With the country's power demand requirements expected to increase at an annual rate of 5 to 6% until 2021, the government has placed clean energy at the heart of its energy strategy. Growing reliance on natural gas imports – currently representing almost all power generation – has made energy diversification a national priority, while the country plans to tackle environmental concerns and strives to evolve as a regional leader in clean energy. As a result, the UAE announced in 2015 a nationwide strategy which aims to have 50% clean energy by 2050. Solar power features heavily in its plans and is expected to account for 25% of the generation mix once a 5GW solar park is fully commissioned in 2030.

While there have been doubts about the country's ability to meet this ambitious target, the progress to date has been impressive. This can mainly be attributed to the current market structure and strong government support. An equally important factor is the access to cheap financing that enabled developers to submit low bids, and on several occasions the UAE has received world record bids for both PV and CSP.

Power projects under construction 2017-2023



■ Nuclear ■ Gas ■ Coal ■ PV ■ CSP

Source: APICORP Research

A look at the bigger picture underlines the crucial importance of solar energy for the country's energy supply security, where almost all power generation capacity is gas-fired. According to

APICORP estimates, the UAE needs to invest at least \$35bn to meet the 17GW capacity addition needed over the medium term. The stringent diversification efforts have already born fruits, with at least 10.4GW already under execution. Abu Dhabi's Barakah nuclear-power plant will see four reactors come on line between 2017 and 2020, contributing 5.6GW in total and representing 41% of new capacity between 2017 and 2023. Gas and coal will represent 21% and 18%, respectively, while solar PV and CSP projects are expected to account for 20% of the UAE's new capacity.

UAE solar energy projects setting new global standards

Unlike other energy-exporting countries in the region that are struggling to kick off their renewable-energy programmes, the UAE is on track to meet its ambitious target. The first local CSP project was the 100MW Shams CSP plant which has been operational since 2014 in Abu Dhabi. The cost of the project was \$600m, and it was financed by a consortium of international banks including BNP Paribas, National Bank of Abu Dhabi and Mizuho. More recently, Abu Dhabi's Sweihan PV project broke the price record previously set by 800MW phase 3 of the Dubai Solar Park, having received the lowest bids from Japan's Marubeni and China's JinkoSolar. It is noteworthy that the plant will become the largest solar PV site globally, surpassing an 850MW plant in China. Initially planned at 350MW, the consortium submitted a proposal for a levelised cost of electricity (LCOE) of \$0.024/kWh but increased the plant's capacity to 1.18GW to enable it to achieve economies of scale. The project will operate under a build, own, operate model and will be owned by state utility Abu Dhabi Water and Electricity Authority (ADWEA, 60%) as well as Marubeni (20%) and JinkoSolar (20%). Like all renewable projects in the UAE, the project will supply electricity under a 25-year power purchase agreement (PPA). The expected cost of the project is around \$872m with international lenders providing financing for the project.

Major projects to come on line by 2020

Project	Type	MW	Year	(\$/kWh)
Sweihan (AD)	PV	1,177	2019	0.0242
Solar Park III (Dubai)	PV	800	2020	0.0299
Solar Park IV (Dubai)	CSP	700	2021	0.073

Source: MEED Projects; APICORP Research

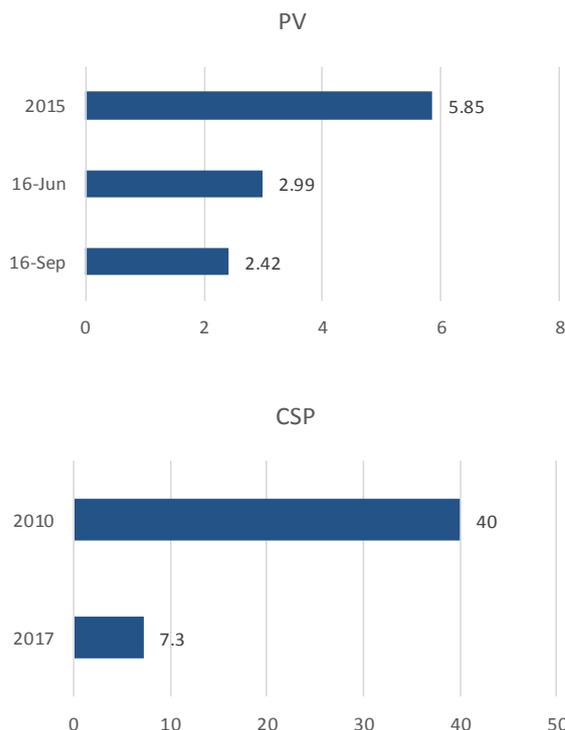
In Dubai, the 13MW Phase I of the Dubai Solar Park was the first PV project completed in 2013. The 200MW Phase II came on line in early 2017, achieving a then-world record of \$0.0584/kWh. Phase III was awarded to a consortium led by Masdar earlier this year, after receiving another then-world record bid of \$0.0299/kWh, with plans to bring 800MW on line by 2020.

More recently, ACWA Power and Shanghai Electric were awarded a contract to build the world's largest CSP project – 700MW constituting Phase IV of the Dubai Solar Park. The consortium offered a LCOE of \$0.073/kWh, breaking the global CSP record held by Morocco's Noor 1 since 2013 (\$0.19/kWh). The initial bid from the consortium was 0.0945/kWh for 200MW, but was later revised down after the capacity of the project was increased to 700MW, enabling them to lower their bids and benefit from economies of scale. The first phase of the project is expected to be commissioned in 2020 and cost over \$3.5bn. While it will only provide around 14% of the park's expected total capacity of 5GW, it accounts for around 28% of the total costs. Although deploying PV for the entire park would have been cheaper, CSP offers a decisive benefit. Most importantly, solar PV can only produce electricity during daylight given the lack of suitable cutting-edge storage technology; whereas CSP is based on thermal energy, giving it a higher degree of flexibility and enabling it to supply electricity at night.

Solar energy prices competitive with conventional energy sources

The success of renewable energy will ultimately rely on cost competitiveness. Between 2010 and 2015, average costs for solar PV energy decreased by 70% and for wind energy by 30% globally, according to the International Energy Agency. An additional 25% and 15% decline, respectively, is expected by 2021. The cost savings are mainly attributed to technological advancements and economies of scale due to increased manufacturing activities in Asia. Continuing investments and additional capacities will result in further cost reductions.

Levelised cost of electricity range for baseload technologies (\$/MWh)



Source: APICORP Research

The last few years have seen some of the lowest solar energy prices obtained in the UAE, with the current solar PV and CSP records being held in the country. These price levels are very promising given that the country currently still relies heavily on importing gas for its power sector. It is particularly worthy of mention that recent solar prices are also competitive against the prices for energy from conventional sources. By way of example, the recent Hassyan coal project secured a 25-year PPA at \$0.045/kWh, yet this has been undercut by two solar PV projects, refuting the widespread perception that renewables are not cost competitive. On the downside, they are unable to match the flexibility and baseload capability of conventional sources. The CSP project, meanwhile, remains more expensive but can be deployed as baseload given that it can produce electricity in the evenings through thermal storage.

Favorable market structure and supporting policies

The UAE boasts one of the most advanced power sectors in the region, with a distinct structure and government policy that is favorable to renewables. Each of the seven emirates have been given control over their own programmes and strategies. Abu Dhabi took its first steps to unbundle the sector in 1998 when it privatised power generation and adopted the single-buyer model. Under this market structure, power generation is open to the private sector, while the state has a monopoly over transmission and distribution and is the only wholesale purchaser from power-generating companies. The main incentive for private developers are government-backed long-term PPAs, where ADWEA guarantees to purchase produced electricity on a 'take or pay' basis. Today, more than 90% of power generation in Abu Dhabi is provided by IPPs.

The market structure in Dubai is similar, and the Dubai Electricity and Water Authority (DEWA) is also increasing its reliance on IPPs. Dubai's large Solar Park operates under the IPP model. Although DEWA and ADWEA allow for participation of the private sector, the two state utilities join all IPP projects as major equity shareholders. The private sector is keen to participate because of the low risk associated with partnering with state utilities and, more importantly, the economic guarantees of PPAs.

Other regulatory support has been pivotal in contributing to the expansion of the country's renewables sector, which include renewable-energy laws and national targets, while economic support mechanisms include net metering and capital grants. Additionally, the UAE's business environment is favourable to international investors, with relaxed trade and fiscal policies that facilitate the inflow and outflow of capital.

Wide availability of affordable financing

Recent solar projects in the UAE have attracted large amounts of capital and access to affordable financing has played a pivotal role in this success. Although financiers were initially reluctant to add a new sector to their portfolios, banks are today very keen to play an active role in the solar energy market. Projects are mainly funded through project finance with high debt to equity ratios. A closer look at the reasons for the wide availability of cheap financing uncovers the following:

First, the UAE has an excellent credit rating. Commercial banks typically require investment grade rating, such as BBB- by S&P, to provide project finance. With the UAE's rating standing at AA with a stable outlook, it does not come as a surprise that the country is on the target list of many international financiers. In the instance of the Dubai solar projects, the off-taker is DEWA.

Although the authority has a rating of BBB-, banks typically consider the country rating and the quality of the government agency that it deals with to determine the level of risk. The UAE and other GCC countries like Saudi Arabia, Qatar and Kuwait are considered very safe, and regional and international banks are comfortable lending to government-backed projects. Additionally, the UAE Dirham is pegged to the US Dollar, which removes another element of risk typically associated with renewables. At times, PPAs are provided in currencies not pegged to the US Dollar, which introduces foreign exchange risk, as is the case in Egypt.

Second, liquidity for investment grade projects is available. Commercial banks at the regional and international level are cash-rich and competing for limited quality investments. Thanks to low or negative interest rates in their countries, European and Japanese banks act as price-setters for regional banks in solar energy financing in the UAE. Compared to their international counterparts, regional banks have higher costs of funding and find themselves challenged to match the rates being offered.

Third, the current market structure based on the IPP model with PPAs in the region is attracting liquidity. Almost all new renewable projects in the region will continue to follow the current model. In the medium-term, this is not expected to change, and indeed, the role of IPPs in the GCC is likely to increase even further. In the UAE, most new power projects – with the exception of the Barakah nuclear power plant – are IPPs with government-backed PPAs, which makes investments very safe. In addition, competitive bidding means that shortlisted developers must engage with commercial banks at a very early stage of the bidding process to determine the LCOE, which usually results in the provision of competitive rates.

Fourth, the large size of funding is attractive. The estimated cost of the 800MW Dubai Solar Park Phase III and the 1.18GW Sweihan project was \$942m (of which \$645m is debt) and \$872m (of which \$650m is debt). The larger the funding, the better the rates will be for financiers, while smaller funding will translate into cheaper rates for the developers. For example, if a solar project requires \$400m of financing, several banks will offer commitments, the sum of which will normally exceed \$400m. The developer will then look at the interest rate of the last bank it needs to complete the \$400m package. This rate will then be applied to all banks. If the project is larger and requires funding of \$1bn, more banks will need to be involved, and the interest rate offered by the final bank it needs to complete the \$1bn package will be higher.

This interest rate will then be applied to the rest of the banks who will benefit from a higher rate than they were willing to accept.

Fifth, projects and policies are typically very clear from the onset and rarely change during the procurement process. This provides investors with certainty and reduces risk. Most of the changes that have happened in the procurement phase of a solar energy project in the UAE came about due to the expansion of a proposed project to benefit from economies of scale, which is viewed positively by investors. Investors are very confident and comfortable with the process and framework, which they expect will last throughout the PPA period.

Setting an example for the region

The UAE has made great strides over the past few years and is leading the region's drive towards renewable energy, particularly in the solar sector. To meet rising demand, the country has embarked on a challenging mission to increase energy security, diversify its energy sources and increase the share of solar in its power mix. The UAE has proven that it possesses some of the best solar resources in the world, while supporting economic and regulatory policies have helped its clean energy programme to excel. A contributing factor is access to affordable finance. In addition to conventional project financing, the sector is seeing financial innovation to help facilitate and provide the investments required in the long term, including the AED100bn Dubai Green Fund, which will support the Shams Dubai initiative, a programme aimed at facilitating the installation of rooftop solar panels.

There is no doubt that regulatory support, including renewable-energy laws and national targets, has been pivotal in contributing to the expansion of the UAE's renewables sector. Several solar PV and CSP projects in Abu Dhabi and Dubai broke world records, with both technologies having received lowest bids recorded globally this year. Further progress is expected as the country is set to reach 7% solar energy by 2020 and 25% by 2030 – its interim targets towards the more ambitious goal of 50% by 2050. With a similar landscape and solar potential in neighboring countries, GCC governments can draw some important lessons from UAE's journey towards clean energy.

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