

Solar piling in the UAE

As nations move from a dependency on fossil fuels, the ground engineering sector is meeting the demand for specialist foundations installs at large solar farms



One of the two Comacchio MC 8 rigs being used to install the foundations for a solar farm in the UAE

The Gulf Cooperation Council region has considerable renewable energy potential, particularly for solar photovoltaic (PV) generation. The United Arab Emirates (UAE) has managed to attract some large-scale solar PV projects, requiring highly productive and cost-effective drilling solutions for the installation of photovoltaic modules.

In 2017, the UAE launched 'Energy Strategy 2050', which aims to increase the contribution of clean energy in the total energy mix from 25 per cent to 50 per cent by 2050 and reduce its carbon footprint of power generation by 70 per cent.

Solar PV is currently the dominant technology in the country's project pipeline. Thanks to the excellent solar resources, combined with the increasing cost-competitiveness of solar technologies and favourable financing, solar PV is emerging as the cheapest source of electricity generation for new projects in the UAE.

Installed solar PV is expected to increase fourfold from now to the end of 2025 to reach 8.5GW, when it will represent around 94 per cent of the country's renewables capacity.

Four solar projects, which are all at various stages of development,

are expected to drive this growth: the Al Dhafra (2GW), Abu Dhabi PV3 (1.5GW), and the fourth phase (950MW) and fifth phase (900MW) of the Mohammad bin Rashid Al Maktoum (MBR) Solar Park located at Saih Al Dahal, approximately 55km south of Dubai City in the UAE.

The MBR plant is said to be the world's largest single-site solar power facility, with a planned total capacity of 5GW when fully operational by 2030. While the first phase of the project saw a 13MW plant completed in late 2013, recently, the 900MW (US\$570 million) fifth phase of the project was awarded by the Dubai Electricity and Water Authority (DEWA) to the consortium led by ACWA Power in partnership with Gulf Investment Corporation (GIC).

"The DEWA auction had very stringent technical and financial requirements during the prequalification stage. That, combined with the large project size, meant that only a few companies with financial and technical credibility could qualify," explains Felice Granisso, CEO of Dubai based TEK Solar LLC, who has been in charge of the PV modules installation within the MBR solar park project since phase 2.

"The project will use the latest bifacial photovoltaic solar panels, which capture sunlight on both sides of the panel and produce energy with an advanced solar tracking system to increase generation efficiency. The quality of the foundation is critical for this type of ground-mounted solar PV installation.

"TEK Solar LLC was established through experience gained by its sister companies, TEA Tek in Italy and TEK Energy in the UK. We hold a leading position in the MENA region providing a full range of services related to the

development and construction of PV plants, with a focus on piling and foundation works, mechanical structures and modules installation, as well as electrical works," continues Granisso, "The foundation forms the backbone of a ground-mounted PV system. It's important to not only select the right foundation type but to ensure that the piles are driven into the ground at precise levels no matter the ground conditions. Large-scale installations also require choosing a contractor with equipment that increases productivity and keeps project costs low."

Installation accuracy is strictly dependant on the soil conditions. The characteristic hot desert terrains of the region have near-surface geology dominated by Quaternary- to Late Pleistocene-age mobile aeolian sands and sabkha/evaporate deposits overlying variably cemented Pleistocene calcareous sandstone and cemented sand deposits of the Ghayathi Formation.

The near-surface geology of coastal Dubai begins with Quaternary marine, aeolian, sabkha and fluvial deposits overlying variably cemented Pleistocene calcareous sandstone and cemented sand deposits of the Ghayathi Formation; where small changes in sea level during this period exposed the sand layers to the atmosphere leading to evaporation and chemical carbonate cementation (Williams and Walkden 2002). Below this, is a thick succession of fluvial sediments characterised by poorly sorted conglomerates and interbedded calcisiltites belonging to the Barzaman Formation probably formed during the middle Miocene to Pliocene age (Styles et al. 2006).

Drilled and cast in place foundations have proven to be

the most reliable solution for this kind of stratigraphy. "These types of projects cover vast areas. They normally require tens of thousands of boreholes with diameters ranging from 125 to 400mm and an average depth of 2m," explains Granisso. "The soil cohesion of the so-called 'transition area' dictates the drilling methodology."

Cohesive cemented sands require the use of DTH drilling with the help of water. Water is used to ensure penetration through the first sandy layer and prevent the borehole from collapsing before the grouting is performed. Less cohesive soils are drilled with the use of 300mm augers.

TeaTek has just completed plot A of phase 5 of the Al Maktoum solar park and is preparing drilling operations for plot B. The company is utilising two Comacchio MC 8 rigs equipped with a 5,000daN mast and a 1,400daNm rotary head.

"The compact size and high manoeuvrability of the Comacchio rig has proved successful to tackle the challenges posed by the project," Granisso.

"The current trend in solar PV plant construction towards achieving maximum productivity while reducing land occupation has resulted in a reduction of the size of the frame structures designed to integrate tracking systems and the PV modules. With less space between trackers the drill rig needs to perform a large number of boreholes in a very tight space," Granisso explains. "Micropiles are drilled to shallow depths, but the operator needs to perform up to 100 drillings per shift. The time needed for tracking, set up and on-hole positioning of the rig must be kept to a minimum, thus the request for a highly manoeuvrable machine."

Granisso continues saying: "At the same time the rig needs

to be powerful to provide enough torque and retraction force to carry out DTH drilling with diameters ranging from 125 to 165mm and to work with augers, extracting 2 to 3m long augers that can reach 300mm diameter and are filled with wet sand. The MC 8 has been customised with a high torque Comacchio rotary head that supports both these drilling methodologies."

In addition to the tricky ground conditions, the desert environment poses particularly unique climatic challenges and stress to every single component of the drilling rig. The operations are adversely affected by windborne dust and high temperatures, changes in temperature and humidity. Tea Tek has therefore invested in a dedicated team of technicians in charge of fleet maintenance and relies on a network of suppliers and service partners located in the industrial areas of Dubai and Sharjah. ▼

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