

# Delivering on record low PPAs

**Project delivery** | Abu Dhabi's giant 1.2GW Sweihan PV plant made headlines last year for achieving a record low bid price. With construction well underway, Tom Kenning and John Parnell look at how the project is being executed

Credit: Sterling & Wilson

Many emerging solar markets of the past two years have been characterised by headline-grabbing bids that trigger very different responses.

The mainstream liberal press uniformly herald that solar has beaten coal on price. Optimists within the solar industry herald another milestone in its development. Sceptics, or realists, depending on your own viewpoint, will question how the project will be delivered at that cost without any direct subsidy.

One project that followed this trajectory was the 1.2GW Sweihan plant in Abu Dhabi. Bids for the project, submitted in September 2016, were all under US\$0.037/kWh with a consortium of Jinko Solar and Japanese conglomerate Marubeni winning out with a bid of US\$0.0242/kWh.

The facility is being delivered for the emirate's utility, the Abu Dhabi Water and Electricity Authority (ADWEA).

To answer the question of how such a project can be delivered, we spoke to Keith Symmers, project director at Sterling & Wilson, the engineering, procurement and construction (EPC) firm charged with the task of delivering one of the world's largest single-site solar farms at a hugely competitive rate.

"Local attitudes for the project are very supportive," he says. "Land grants and project sponsorship by ADWEA helps to put an official stamp on the project. That said, the local municipality (Al Ain, Abu

Dhabi, UAE) is the agency with jurisdiction on all permitting, with no shortcuts given. Once design is complete, permitting steps take four to eight weeks."

The project is considered part of the UAE's wider economic objectives to free up oil for export, create local jobs and decarbonise its electricity generation while meeting soaring demand. But anyone looking in from the outside should be mindful of Symmers' appraisal, "no shortcuts".

This is where external perspectives on project development in emerging solar markets can diverge from reality. There is nothing new about state-owned utilities freeing up land for infrastructure, particularly in countries where land is readily available. It makes perfect sense to trade that land for a lower PPA. Many European governments will be envious of the opportunity to trade land for low PPA prices rather than the administrative and financial burden of legacy feed-in tariffs and clean energy certificate schemes. The US, under the previous administration, also sought to open up government-owned land for solar development.

Together ADWEA, Jinko Solar and Marubeni have formed a project company to act as an independent power provider (IPP) and deliver on the PPA contract.

## System design

With a targeted completion date in 2019, S&W has the unique problem of deliver-

## Construction of Sweihan is due for completion in 2019

ing on a project so large that the technical landscape for solar projects will have had time to move on considerably from when it was appointed in June 2017 to the final commissioning date.

From grading the site to component selection, S&W is faced with the challenge of maximising output with proven technologies while mitigating for the environment the project will operate in.

"The land is greenfield desert in Abu Dhabi. It is characterised as medium density sand mixed with gatch, a clay-rich sand, but some areas are hardened sandstone. Sand dunes, around 8m high, needed to be graded, with sand used as a fill mixture in low areas as well as to backfill buried cable trenches," says Symmers.

Possibly with scale in mind, 1,500V(DC) architecture was rejected with the wide availability of 1,000V components winning out.

"Structural design responsibility lies with S&W. Design aspects are supported by Krinner ground screws and a superstructure from Greencells. More than 300km of cable is to be installed. Four separate cable manufacturers are being used based on adherence to standards, pre-approvals by the utility, cost, manufacturing capacity, transportation time, and adherence to our delivery schedule."

Symmers explains that the project has been split into five portions, with each of those divided down into blocks.

"Four Ingeteam Sun 1165TL PowerMax

B420 inverters are used in each block," he says. "Selection was based on suitability to meet the functional specifications of the project, company reputation, manufacturing capacity, warranty terms, service level agreement, and delivery schedule."

According to Ingeteam's own specifications, the B420 inverter has a recommended array power of 1,178-1,513.2kWp, meaning each block is somewhere between 4.8 and 6MW.

The emphasis put on delivery schedules goes some way to further explain the choice of 1,000V architecture for a project of the sort of scale that some may have thought was a solid choice for 1,500V.

### East-west

There are more surprises still when we look at the site layout.

"We're not using a tracker. Instead, an east-west design, with half the panels facing east at a five-degree tilt and half facing west at the same tilt," Symmers says.

It's worth remembering how dramatically air-conditioning impacts on the demand profile in the region compared to say, parts of California, where the peak smoothing of a single-axis tracker has become near ubiquitous. The east-west option over trackers could be partly to do with the scale of this 1.2GW project. Even market leader NEXTracker has installed 10GW in its entire history and at the time of writing stated that the largest single install was "over 300MW".

The density of the site is also interesting. The project is one of abundance but it is also one of economy.

"Aside from interior roads, there is no gap on site larger than 1m. This design maximises the energy density at this latitude and region of the world," says Symmers.

This compact design is in part enabled by the proposed robotic cleaning process. This removes the need for wide channels between the banks of arrays to accommodate vehicle-based cleaning. A waterless system will be used for this. S&W has the O&M contract for the first two years of operation.

Less surprising is the use of modules from consortium partner Jinko Solar. As a partner, it is highly unlikely that Jinko's margin on the panels matches what a third-party sale would generate, offering yet more efficiencies. The selection of high-power modules again highlights the issue of energy density that seems to define S&W's approach.

"We are using Jinko Solar's Eagle PERC 72 355-370W modules, approximately 3.3 million of them in total. They have high reliability, bankability, manufacturing capacity and high efficiency for the constraints to maximise power given a set project boundary," explains Symmers.

### The great unknowns

There are of course other factors that contribute to the PPA price outwith the system itself.

It is understood that a 1.6 multiplier will be in place during the summer months lifting the average annual PPA price to something closer to US\$0.29/kWh over the course of the year.

Financing details for the project are relatively sparse, with a "syndicate of local and international" banks involved. The state utility will be considered a reliable off-taker.

It is a safe assumption that ADWEA, as a project partner, would also have drawn highly favourable financing conditions, from banks local and otherwise. Marubeni, an US\$11 billion company in its own right, is also going to be able to attract beneficial interest rates. Grid connection charges for the plant, some 120km from Abu Dhabi, are also likely to have been in some way absorbed by the state.

### Lows

Clearly not all low tariffs are created equal. Be they in Mexico, India, Saudi Arabia or the UAE, there is always more to the story than the headline figures themselves. But

the support afforded to these projects, be it subsidised grid connection or free land, is a more solid foundation for a low PPA than, for example, a strike price. These bids, which either top up the rate to match market prices or see the provider reimburse the guarantor if market prices move above the "strike price", create variable outlay, or income for the governments involved. The pitfalls of feed-in tariffs have featured plenty on the pages of this journal.

Critics point to the provision of land and cheap finance as explanations of why these prices are not market driven. Governments and regulators are defining partners in energy markets, however. That's unlikely to change while energy continues to be of such huge strategic importance.

Complaining about these conditions, or comparing the prices across borders, where conditions vary greatly, is neither productive nor warranted. Solar power is of sufficient importance in a number of emerging economies that governments are offering the same sort of assistance that as long been used to seed road building or deep water ports or coal-fired generation.

The Sweihan project may not demonstrate a route to US\$0.272/kWh solar in Germany, but with a focus on energy density and tight control on logistics, you can understand how the price can be made to work under these conditions.

Understanding any eye-wateringly low PV tariff requires a pragmatic consideration of the project's full context. Comparing tariffs across borders is fruitless. Equally, so is complaining about an energy investment receiving assistance from a host government.

Over the border in neighbouring emirate Dubai, its own state utility is building a "clean coal" plant at what is expected to be a global low for power generation anywhere in the world. You can be sure that concessions made to that project, which again is a strategic choice to diversify the fuel mix, are similar to those Sweihan will receive.

In short, behind the tariffs, are the details. Perceived cash-rich Gulf states are not throwing good money after bad and they are not treating solar as a low carbon loss-leader. Speaking about Saudi Arabia's own record low tariffs (US\$0.017/kWh), the Saudi solar trade body said that "they do not reflect private sector economic reality". With the energy industry so entrenched in public sector policy, that might not be a fair reality within which to judge solar's lows. ■

**The land on which Sweihan is being built is predominantly clayey sand and stone**



Credit: Sterling & Wilson