Project | briefing

EUROPE'S LARGEST SOLAR PARK GOES ONLINE

Project name: Cestas solar power plant
Location: Cestas, near Bordeaux, France
Project capacity: 300MW (DC), 272MW (AC)
Site: 250 hectares

The largest PV project in Europe, a 300MW solar park from France-based developer Neoen, was recently connected to the grid in south-western France. The project in Cestas marks a significant milestone for France's renewable energy history, standing at nearly three times the capacity of the country's previous largest solar project of 115MW. Neoen took on the €360 million (US$403 million) project with several co-investors. The project will produce enough electricity for a quarter of a million people, excluding heating, which is the equivalent of the population of the neighbouring port city of Bordeaux.

Guilhem de Tyssandier, the Neoen project manager, who has been on site since the beginning of the construction phase 12 months ago, took *PV Tech Power* around the 250-hectare park for a closer look at the mammoth installation.

Neoen, a subsidiary of Impala SAS, develops, finances, builds and operates renewable energy plants in France, Portugal, Australia, Mexico, Egypt and El Salvador, with its largest project before Cestas, in Portugal, standing at just 13MW. It will soon also embark on a 100MW PV project in Salvador in Central America. The Cestas solar park is divided into 25 separate plants of 12MW each. Neoen owns 40% of the park with several investors owning the remaining 60%.

Tyssandier says it was important to be connected to the grid on time in order to receive the full level of feed-in tariff (FiT) subsidies from the French government; these are subject to a degression for each month of delay. He claimed it will be difficult to build a similar size project elsewhere in France due to the current regulatory framework and the low level of the FiT.

Construction

The full 300MW was constructed in 10 months, finishing in early September, with the works handled by a consortium composed of Eiffage, its subsidiary Clemessy, Schneider Electric and Krinner.

Eiffage and Clemessy were in charge of the global supervision of the workings, logistics, civil works and cabling. Schneider Electric supplied a high voltage substation and the 200 PV boxes scattered across the site, which include Conext Core XC inverters, medium voltage substations and power plant controllers. Meanwhile screw foundations manufacturer Krinner took control of the supporting structure and installation of modules.

Two teams of 40-50 workers were installing 5MW a day at the height of the operation using a unique construction model which involved only having to slide the modules into the supporting structures without any screwing required. Bespoke trailers, known as 'little trains' were made to carry the panels with room for two workers, allowing them to slide in the panels with maximum efficiency. This technique allowed the teams to reach heights of installing 15,000 modules per day. Tyssandier adds that it was a very complex and lengthy planning process, but it was necessary in order to carry out such an efficient assembly.

Neoen decided to source modules from three different China-based manufacturers –Trina Solar (20%), Yingli (40%) and Canadian Solar (40%).

Tyssandier says: "We needed to mitigate the risks and no one supplier was able to provide several projects in such a short time. You never know – even if they are the biggest producer in the world. We cannot afford to be dependent on one supplier."

Spreading the risk for such a colossal project would also allow one of the three selected manufacturers to act as a backup should one of the supply chains fail. Neoen has performed many control tests outside the plant and it used a mobile test unit for infrared assessments and electroluminescence testing of the modules.

Credit: Gimball Prod

Location and logistics

All this equipment required a highly coordinated logistics procedure, with the daily arrival of between 15-20 truckloads of components. The operation required a base camp of 250 workers with four large tents to store and protect the modules onsite, although modules could generally only be stored for two days before more shipments came in. Tyssandier says that most projects require one person in charge of operations, but for Cestas several people were required to direct and organise the work as their single role.

Due to the proximity to a major port in Bordeaux, there was little problem with access to the plant, however, for the largest items such as the high voltage transformer "exceptional transportation means" were required. This involved a special night time only transportation of the two transformers by road. Bespoke roads also had to be built onsite to enable swift transportation and construction, including in wet conditions. This is hardly surprising on a single location spanning the size of hundreds of football pitches.

The plant, which can power 150,000 people, if you include heating, is located in an area of scrubland that was partially damaged by strong tempest winds coming from the Atlantic Ocean on the West Coast of France. As a result almost every part of the plant had to be designed to withstand the effects of the gales. This includes using aluminium beams and keeping the panels at a low angle to minimise strain, whilst reinforcing the table structures on the west side of each panel as well as all the cables.

To compensate for the land use, Neoen has planted pines and other species of trees over 226 hectares of land across the Gironde area. The site itself only required a small amount of levelling to be workable as it was already fairly flat. The soil was levelled and grass was planted before

By Tom Kenning


Credit: Gimball Prod

embarking on construction.

In terms of security, a fence is in place around the site along with tunnel cameras and physical security guards at construction stages. There are also three wells on site for firefighters to use; forest fires are frequent in this region as summers can see temperatures of up to 42 degrees Celsius with a very dry and sunny climate.

Before starting work, Neoen organised a public meeting with locals to explain the plans including what the modules are made of and how the construction would take place. The lack of screws meant it would be less noisy. They also explained the attractive price of the electricity being produced from the plant.

Design

In terms of orientation within the plant, the modules are installed in an east-west position. This allows for 1MW to be deployed on just 0.8 hectares of land, as opposed to the standard south facing plants, which need in general two hectares per 1MW. This high density of panels required extreme precision at the top of each structure to ensure no panel is causing shading on the other side of the structures. The installers used a laser system and GPS to maintain accuracy with each beam.

While Neoen has used trackers in some of its other projects, an east-west fixed tilt design was the most suitable for the Cestas park because of the limited land space and a mandate to squeeze the maximum possible energy out of the available land space – even if this involved using a greater number of modules.

While tables of 60 modules have been duplicated across the whole plant, each 12MW plant has been deployed in a slightly different shape to accommodate the space available. Tyssandier says the modules have 72 cells, which until recently were not widely used, with 60 cells being the norm. Nevertheless, he says 72-cell modules are becoming more popular, because developers then need fewer modules and connections and less operational labour.

Tyssandier says: "Compared to standard orientation, perhaps we lose 10% [efficiency], but we are able to put in between two to three times more modules."

Furthermore, the east-west placing produces a more level energy generation throughout the day, putting less pressure on the grid, by producing electricity slightly earlier in the morning, later in the day and having a smaller peak at midday.

Levelised cost of electricity

The solar park has been connected to the high voltage network Réseau de Transport d' Électricité (RTE) under a 20-year power purchase agreement (PPA) with the utility EDF.

Tyssandier says the RTE, which is connected to the whole of France, normally deals with very high levels of powers predominantly from nuclear or hydro plants. However, in the case of Cestas the levels of power are so large that it must use the RTE, because medium voltage grids do not have the capacity to absorb all the electricity.

Credit: Tom Kenning

Neoen will be able to sell electricity at €105/MWh, which is lower than the €129/MWh (at current exchange rate) price attached to the proposed Hinckley Point C nuclear reactor plant in the UK. Tyssandier says the price for the Cestas plant has come down three-fold from five years ago when the selling price for solar was around €300-350/MWh. The solar park will now produce more than 350GWh of electricity per year.

Tyssandier adds: "One of the major criticisms of solar power has been price, […] but now we are working in some countries on projects for powering mines, for example with [energy] storage, where the choice of solar is the only economical option – nothing else."

The sheer size of the Cestas project has helped bring the price down, but the major contributing factor has been the lowering in price of PV modules over the last few years. Cabling and structure prices have decreased, but not on the same scale.

Tyssandier adds that for a plant this size it is very important to be able to be highly reactive to the grid. There is a strong requirement from the RTE in terms of electricity quality control and reactivity and these capabilities came down to Schneider Electric's inverter technology.

Operations and maintenance

The project employs two SCADA systems – one for the Conext Core XC inverters and the 200 PV boxes, the other for the high-voltage station. The advantage of using the PV boxes containing the inverters and a transformer is that they arrive onsite ready-made and the only preparation required is levelling the soil. Being able to build the inverter in a factory also ensures quality and less trouble with logistics than assembling onsite.

When asked about the new trend for using 1,500V systems, Tyssandier says Neoen opted for 1,000V as it needed to use proven technology for bankability. Tyssandier adds: "Perhaps we will pass to this (1,500V) in the comings years, but right now it is still too new to be sure that this is risk proof."

When it comes to operations and maintenance (O&M) Eiffage had to design a special system to be able to clean the panels. The panels are densely packed in with the east-west orientation so there is only a 1.2-metre gap to pass between each row of panels. The bespoke system has a rotating brush attached and it uses water for cleaning.

Tyssandier says: "Frankly speaking until now we have seen that the rain is sufficient to clean them, but for sure you need at least one cleaning per year. It's the first time we had a specially built cleaner and this is possible because it is such a big project, otherwise it is an inane investment."

There are five workers permanently dedicated to operating and maintaining the projects as well as several temporary workers for maintenance now and again. In addition to cleaning and grass-cutting, which itself required a bespoke lawnmower for the park, teams need to carry out visual and electrical checks, and drones are used for some of the testing. The drones are able to identify defects at a cell level, although this requires extremely powerful cameras.

Like many solar project developers these days, Neoen also uses drones for marketing and to generate a media following. Tyssandier says drones can also be used to control reporting to investors as the footage can clearly show the progress of construction.

At a time of solar subsidies being cut or phased out across Europe, Neoen's achievement of building the continent's largest solar installation is highly impressive and on current news there seems to be very little in the European pipeline that threatens to surpass it in size.

Cestas in numbers

- 983,500 panels – 305 Wp (Trina Solar, Yingli Solar, Canadian solar)
- 204,000 foundation screws (Krinner)
- 16,500 supporting structures (Krinner)
- 800km underground cables, 3,700km aerial cables (Nexans)
- 3,800 DC Junction boxes
- 200 PV Boxes (Schneider Electric) = 400 inverters 680 kVA + 200 transformers 1360 kVA (0,4/33 kV)
- 1 HV substation (Schneider Electric) with 2 transformers 140 MVA (33/225 kV)
- Connection to RTE 225 kV grid (1,700m underground cables) ■

Credit: Tom Kenning