As part of its commitment to sustainable manufacturing, Viridian Solar installed a solar photovoltaic system on the roof of its HQ and factory in Papworth, Cambridge, UK. After a first year of running, the results are in...

Solar for Industrial Buildings

The business has a high demand for electricity, used for factory lighting, generating compressed air and running plant and equipment, as well as for the offices. Since there is little year-round demand for heat, a solar PV array was the best option for on-site renewable energy generation.

System Design

The building is a steel frame with insulated steel panel cladding. Its roof is pitched at only 6 degrees to the horizontal, the pitches facing southeast and northwest. There is a row of trees behind the building, but these are mature and do not shade the roof.

The building has a generous area of roof windows and energy efficient lighting which regulates electricity consumption as natural light levels vary. The panel layout avoids shading the roof windows to maintain levels of natural light inside the building.

There is no permanent access to the roof for cleaning and panels installed at a pitch at below 10 degrees are prone to collect dust. By pitching the panels up from the roof at an angle higher than ten degrees, the action of rain maintains a clean surface. The chosen angle was 35 degrees, maximising energy output per panel, but requiring spaces between the rows of panels to avoid self-shading.

Clearline solar panels are available in three sizes, so the use of the available roof space was optimised by locating smaller panel formats in the front rows to reduce the row spacing required to avoid shading.

The roof layout showing the wiring configuration is illustrated in the diagram below. Panels were wired in series strings to three phase inverters. The strings were connected along the rows to simplify wiring runs and combine together panels that are subject to similar lighting conditions.

Energy Performance

The energy generated by the PV array has been logged for the first year of running (March 2012 - 2013). In addition, the proportion of electricity exported to the grid has been recorded from the electricity meter.
The graph below shows the balance of electricity use for this first year (formatted as a calendar year).

The hatched line bars show the electricity imported to the building net, of export. The PV installation has reduced net electricity consumption by 44%, preventing the emission of 22 tonnes of carbon dioxide each year.

According to the MET office, levels of sunlight in 2012 were 99% of the long-term average.

The measured energy production is 15% higher than predicted by the government’s Standard Assessment Procedure (SAP) and 5% higher than the method in the MCS Guide to the Installation of Photovoltaic Systems.

Over the 12 month period, the system generated a total of 42,138 kWh of electricity. Of this 26,933 kWh was used on site (dark green bars) and 15,205 kWh was exported to the grid (white bars). 64% of the generated electricity was used on site and 36% sold back to the electricity supplier.

The PV array was designed and installed by Viridian Solar’s staff over the course of a week.