OLD WOOD ENERGY PARK
APP REF: 24/00161/FUL
SOLAR FARM - ELECTRICITY GENERATING CAPACITY STATEMENT

Individual solar panels generate electricity in direct current (DC) form. The panels are electrically grouped in strings, and the electricity generated from each string is transferred in cables to an inverter, which is used to convert the DC electricity to alternating current (AC). A percentage of the electricity is lost in this conversion, meaning that the total peak DC wattage (or Watt-peak (Wp)) is greater than the AC output. The AC electricity is then able to be passed through a transformer which is used to step up the voltage for export to the grid.

Under the recently published National Policy Statement for Renewable Energy Infrastructure (EN-3)[1], clarification is provided under paragraph 2.10.53 that the maximum combined capacity of the installed inverters (measured in alternating current (AC)) should be used for the purposes of determining the capacity of a solar farm.

The Planning Statement details the infrastructure proposed and the maximum parameters assessed in the application. At present the exact solar panel or inverter model has not been selected for the Development, given the historic and future potential for rapid advances in technology and component efficiency. Therefore, the precise DC watt-peak and exact number of panels or inverters has not been fixed.

Typical elevations of the solar panels are shown on drawing WLL02A-EXG-05-ZZ-D-K010-P02 Solar Panel. These indicate a range of parameters but any final panel would fit within the maximum, and therefore worst-case parameters shown. The layout presented with the planning application includes 110,808 panels. On the basis that the panels could each be 590 Wp, this would give a total capacity of circa 65.38 MWp DC. If at the time of construction, the watt-peak of the panels was to be increased then fewer panels could be required, and the extent of the Development could be reduced or the DC rating of the site could be increased for the same utilised land.

The number of inverters would depend on the capacity of the inverter selected. On the basis that each inverter has a rated output of between 1.75 and 2 MW then 25 would be required; this is considered to be the maximum and therefore worst-case and what is shown on the layout plan. If the capacity of each inverter increased then the number of inverters required could decrease. As with the panels, the size of the inverters would fit within the maximum worst-case sizes as detailed in the Planning Statement and shown on drawing WLL02A-EXG-05-ZZ-D-K002-P01 MV Inverter.

Critically, what is fixed is the aggregated rated output of installed inverters would be no more than 49.9MW AC. The number and size of the solar panels has been designed to optimise the performance of the inverters and the output of the site. Section 2.10.61 of EN-3 supports this, stating that an objective of efficient design should be to maximise the potential power output of the site.

The overall area within the red line planning boundary, including the battery energy storage system (BESS), substation, landscaping and cable route is 100.96 hectares (ha) and this indicates the maximum extent of the Development. However, within this red line the solar farm infrastructure (i.e., the fenced area containing panels) occupies an area of approximately 68 ha (or circa 68% of the Site). Paragraph 2.10.17 of EN-3 states that a solar farm typically requires between two and four acres (between 0.8 and 1.6 hectares) for each MW of output. For a circa 50MW AC solar farm this would be 40 to 80 ha so 68.9 ha fits within this bracket. EN-3 further states that a circa 50MW AC solar farm would have between 100,000 and 150,000 solar panels, noting this would vary between sites. The Development has 110,808 panels and so is at the lower end of the expected range.

Footnote 92 of EN-3 explains ‘overplanting’ (i.e., allowing for a higher DC watt-peak than the AC output capacity) in solar farm developments and confirms that the approach is an acceptable one. This

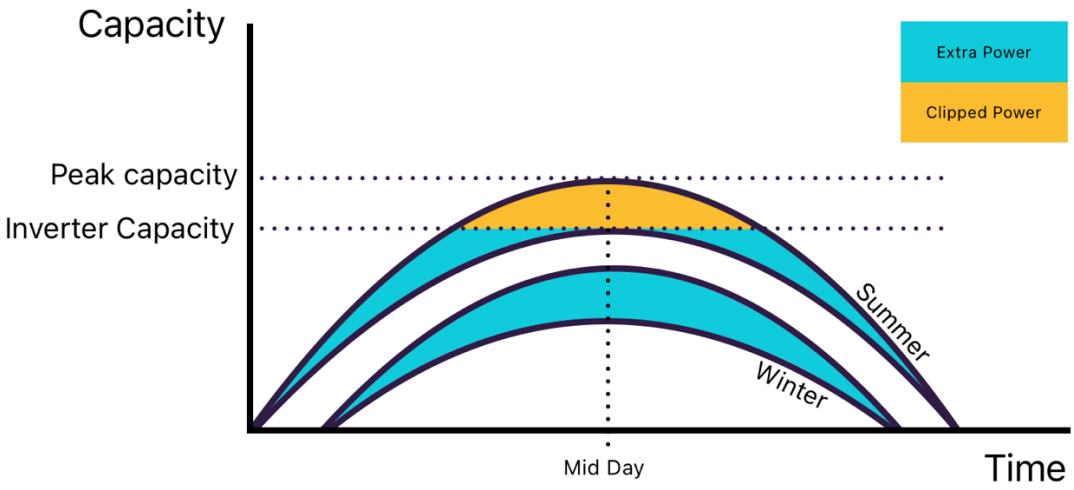
[1] https://assets.publishing.service.gov.uk/media/65a7889996a5ec000d731aba/nps-renewable-energy-infrastructure-en3.pdf Accessed 13/03/2024

planning application has demonstrated that the resulting scale of the Development, as proposed and incorporating a reasonable level of overplanting, is acceptable in terms of its effects and impacts on the environment, with mitigation as proposed.

The main reasons for overplanting are to seek to maximise the renewable energy-generating efficiency of the Development and to, therefore, make best use of the export capacity that has been secured. Solar farms have variable output over time and overplanting allows the project to deliver a more consistent level of energy to the grid, both over the course of the day and the year. A very short period of 'clipped' power in mid summer is more than compensated by additional generation over the rest of the year when the solar farm is operating below peak capacity. Most often, the extent of necessary overplanting cannot be accurately calculated at the time of the planning application as the efficiency and generating potential of panels is constantly changing (improving) with technological advances. However, in determining the extent of overplanting there have been the following considerations:

- Power losses with converting DC to AC;
- Degradation in panel efficiency over time;
- Times of low irradiation (i.e. when it is cloudy, or at dawn and dusk); and
- Shading such as from trees, particularly in the winter months at dawn and dusk, as well as shading between rows of panels.

A higher ratio of DC:AC results in greater 'clipping' in the summer, which occurs when the panels could produce more output, but the actual generation is restricted by the inverters; on the contrary, this allows for more efficient utilisation of the inverters throughout most of the rest of the year, which generally correlates to when the need for the energy is greater. This approach then assists with smoothing the 'peak' of the typical solar generation curve profile by extending the time when maximum generation occurs in the day. This is illustrated by the below graphic.



In summary the installed solar panel capacity of the Old Wood Energy Park is 65.38MWp DC (subject to panel type), with a maximum combined rated capacity of the installed inverters of no more than 49.9MW AC. It is this latter value which is the value used to define the capacity of the solar farm in accordance with paragraph 2.10.53 of EN-3.