West Berkshire Groundwater Scheme (WBGWS): Solar Panel Project

Project context

What is the purpose of this project? What are the needs?

The WBGWS is one of the largest groundwater drought augmentation schemes owned and operated by the Environment Agency. It comprises 32 pumping stations connected to four major outfalls through 87km of pipeline. Please note that this asset is only operated in the incidence of drought.

We want to install solar photovoltaic panels at some of the sites so that some of the electricity supplied is directly from renewable energy.

Below is a summary of the energy consumption of the WBGWS during an average winter and summer whilst the scheme is non-operational. This will reduce the operational carbon footprint associated with the pumping station.

Data source	Energy consumed (kWh)	Conversion factor	Carbon emission (kgCO2e)
Energy hub: Average monthly consumption per station (32 in total) - Winter	503.12	0.28307	142.42
Energy hub: Average monthly consumption per station (32 in total) - summer	196.12	0.28307	55.52

We do not expect solar panels to provide sufficient power to operate the pumps.

Project perimeter

What are the outlines and limits of the project?

General requirements

- The project will include design, installation, commission and documentation of the PV plant. The PV plant shall be delivered turnkey and include all the required equipment such as PV modules, inverters, wiring, junction boxes, DC and AC switches, including general AC switch located in the main electrical switchboard, surge protection, battery bank (one site only), operation monitoring with display and documentation. Detail can be found in the technical description section of this document.
- The PV Plant shall comply with all applicable requirements regarding fire safety concerns and shall be equipped with lightning and surge protection.
- The PV Plant shall be connected to the local electrical grid.
- The installation of the PV Plant shall be performed in compliance with the Work at Height Regulations 2005.
- Installation shall be performed with relevant qualifications including NICEIC registration.

Outlines of project

- Electrical: Ensuring sufficient space in main electrical switchboard
- Mechanical: existing completed and insulated roof or facades. Establishing pathway through exterior/interior walls/slabs for electrical cables, and subsequent patching.

Limitations

- A capital project is occurring on the pumping station infrastructure. Nothing can be done to compromise with this project. This includes:
  - Avoid connecting the solar panels to control panels
  - Determining the best place for inverters/ batteries inside the pumping stations. The pumping stations have limited space and space still needs to be available for the capital project.
  - Fixture to pumping stations roof is preferable.

Timescale

All work must be completed by 31st March 2022. Earlier completion would be preferrable.

Technical information

Possible sites for this project include:

Site	NGR	Postcode	W3W
Ashridge Wood	SU 49643 77851	RG20 8SJ	///clubbing.canoe.blending
North Fawley	SU 40002 81550	OX12 9NJ	///accordion.offices.standard
South Fawley West	SU 38478 80166	OX12 9NL	//lorry.youths.crown
Gore Hill	SU 49565 82462	RG20 7LZ	///focus.scream.deep
Knollend	SU 45635 82925	OX12 8NY	///skylight.duos.paddock

*Ashridge and Knollend priority sites

- The PV Plant shall be designed in compliance with the standard IEC 60364-7-712 (Electrical installations of buildings – Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems).
- All the components of the PV Plant shall be in compliance with the standard IEC 62093 (Balance-of-system components for photovoltaic systems – Design qualification natural environments).
- The PV Plant shall be designed so that daily operation and periodic maintenance and inspection can be easily performed.

Minimum performance requirements

- The power of the PV Plant shall be indicated in kWp (Kilowatt Peak) at Standard Test Conditions (STC), according to IEC 60904-3 (Photovoltaic devices – Measurements principles for terrestrial photovoltaic (PV) solar devices with reference spectral irradiance data).
- A simulation showing expected output is required. The simulation/calculation method shall be documented (complete software report and assumptions).

Equipment: PV modules

- The PV modules shall have a power warranty of minimum 80 % at STC (Standard Test Condition) after 25 years. The product warranty shall be at least 10 years.
- In order to achieve the energy production requirements, high efficiency PV modules are preferred.
- The PV Plant shall consist of only one type of PV module and all the modules shall have the same rated power.
- It is assumed that the module strings are optimized to minimize the mismatch losses according to the flash test data.
- The PV modules shall be in compliance with the following standards:
- IEC 61215 (Crystalline silicon terrestrial photovoltaic (PV) modules – Design qualification and type approval)
- IEC 61730-1 (Photovoltaic (PV) module safety qualification – Requirements for construction)
- IEC 61730-2 (Photovoltaic (PV) module safety qualification – Requirements for testing)
- IEC 62716 (Photovoltaic (PV) modules – Ammonia corrosion testing)
- IEC 61701 (Salt mist corrosion testing of photovoltaic (PV) modules)

Inverters

- The inverters shall be approved for solar photovoltaic applications.
- The inverters shall be adapted for the connection to the local electrical grid and the grounding system (IT-230 V).
- The inverters' warranty shall be minimum 5 years. The offer shall include an extended warranty up to 10 years as an option.
- The inverters shall be in compliance with the following standards:
    - *IEC 61727* (Photovoltaic (PV) systems – Characteristics of the utility interface) or *EN 50438* (Requirements for micro-generating plants to be connected in parallel with public low-voltage distribution networks)

- *DIN V VDE 0126-1* (Automatic disconnection device between a grid-parallel generator and the public low-voltage network)
- *IEC 62103* (Electronic equipment for use in power installations) or *EN 50178*

- The inverters shall be located so that daily operation and periodic maintenance and inspection can be easily performed. All inverters shall be labelled in order to ease the O&M.

Wiring

- All DC cables shall be approved solar cables for outdoor use.
- Cabling will be armoured, buried (0.5m) and ducted.
- The cable length shall be kept as short as possible.
- Interconnections between module cables and string cables shall be made with connectors type MC4 using the equipment recommended by the supplier.
- The cables shall be fixed (with UV-resistant plastic strips, for example) to avoid movement and mechanical damage.
- Cable entry through the roof/wall structures shall be performed without damaging the function of the roof/wall or its insulation.
- The offer shall include AC cables to connect the PV Plant to the general AC switch located in the main electrical switchboard.
- All cables shall be labelled in order to ease the O&M.

Mounting system

If roof/ wall mounted (preferred option):

- The PV modules are mounted on an existing completed and insulated roof, as a BAPV (Building Adapted PV) system.
- The mounting system shall not impact the insulation neither the sealing of the roof/facade.
- The fastening system of the PV Plant to the existing roof shall be documented in detail.
- PV arrays shall be ideally at an angle between 40°-50°
- The mounting system shall allow air circulation between the PV modules and the roof.

Overvoltage and Grounding System

- The PV Plant shall include a protection against destruction by lightning.
- The PV Plant, including the mounting system, shall be grounded in accordance with requirements from the suppliers of PV modules, inverters and mounting system.

Fire Protection

- Inverters and cables shall be located to meet all the fire safety requirements, following the general guidelines given in ASTM E2908 (Standard guide for fire prevention for photovoltaic panels, modules, and systems).

Display

- The PV Plant shall include a digital display at the entrance of the building that shows live production and total cumulative production and/or annual production.
- The equipment, installation and wiring of the display shall be included in the offer as an option. Requirements for detailed execution shall be clarified with the construction manager on site.

Documentation

General

- All documentation, product information and datasheet of every component of the PV Plant shall be delivered with the commissioning, according to the standard EN 62446 (Grid connected photovoltaic systems – Minimum requirements for system documentation, commissioning tests and inspection).

Annual Production

- The estimation of the annual production shall be documented (list of detailed assumptions and complete software report). The simulation shall be performed with a software using hourly based calculations and widely used in the solar industry.

Operation Manual

- An Operation Manual shall be delivered with the PV Plant. The Operation Manual shall include procedures for the daily operation and describe the needs for periodic maintenance and inspection.

Commissioning and Test

- The commissioning of the PV Plant shall be performed by an independent third party in accordance with its own procedures and checklists for technical takeover.

- In order to ensure that the PV Plant meets the minimum performance requirements, a PR (Performance Ratio) test shall be performed during the commissioning. The results of the test shall attest the quality and the efficiency of the PV Plant.

Warranty

- The Operation Manual shall include an overview of the different components, warranties and warranty terms.
- The product warranty for the whole PV Plant shall be minimum 5 years.
- If the PV Plant or any of its components does not meet the specifications during the warranty period, it shall be rectified without any delay and at no additional cost.
- The warranty shall apply in case of any component showing a malfunction or a significant change in its mechanical or electrical function that can increase the risk of a malfunction.