

Ground Mounted
Solar PV at Leighton Grange

TECHNICAL SPECIFICATION

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APPENDICES

Appendix 1 – Land Asset in Crewe – outline design and location plan

Appendix 2 – SPEN Grid Connection Offer

Appendix 3 – Planning permission document with planning conditions outlined

Appendix 4 – Indicative Yield Assessment

Appendix 5 – Standard Conditions for Works Adjacent to United Utilities Pipeline

1. Project Introduction

1.1 Project Background

Cheshire East Council is the third largest council in the Northwest of England, responsible for over 500 services and with a population of over 375,000. Its annual turnover exceeds £700m and its resources are well managed through a budgetary framework. The Council has a clear vision for 'Working for the brighter future together' and guided by the principles of our Medium Term Financial Strategy:-

- Investing available balances to achieve low risk returns
- Utilising an approach to borrowing
- Providing opportunities for commercial investment that's supports outcomes and provides financial returns
- Maintaining adequate reserves to manage financial risks and prevent short term deficits

A potentially significant and beneficial impact can be made by the investment in Renewable Energy technologies, which could provide a revenue stream that would contribute towards maintaining Council services at a time of unprecedented financial pressure.

Cheshire East Council has been installing energy efficiency and renewable energy technologies since the early 2000's and have made significant energy savings over the years. Energy Conservation Measures related projects are guided by the Carbon Neutral Action Plan.

One of the core priorities in the 2017-2023 Council Plan is 'A Green Council' with a key impact of reducing energy consumption and using and developing alternative/renewable energy production. Therefore, developing renewable energy schemes is a core component of achieving this priority.

The Council's Carbon Neutral Action Plan details key actions for reducing the Council's energy related carbon emissions to achieve a target of a 60% reduction by 2025. Installing renewable energy is a core component of the Carbon Management Plan, particularly building integrated renewables. The Council has achieved a 51% reduction in energy related carbon emissions against the 2007/08 baseline.

The Carbon Neutral Action Plan aims to assess and develop large scale renewable energy systems on Cheshire East Council owned land and assets to ensure that the social, economic and environmental benefits of renewable and low carbon energy generation are maximised by the Council.

Cheshire East Council (the Council) wishes to install a 5.4 MWp ground mounted solar PV system on a land adjacent to the In-Vehicle Composting (IVC) facility in Crewe. Please see **Appendix 1** for information regarding Land Asset in Crewe.

The Full Council have agreed to the following works:

- Confirming the grid connections

- Obtaining planning permission.
- Establishing a power purchase agreement for the IVC site
- Seeking accurate capital and operational costs.

The site has confirmed, secured grid connections from SP Energy Networks (**Appendix 2**). Planning permission for the site has been granted at the March Planning Committee and a list of planning conditions is provided in **Appendix 3**.

The Council is now seeking proposals for the turnkey design, installation and commissioning of the system with private wire and grid connection to form a fully compliant and working installation. It is anticipated that the contract will be awarded in June 2022, and the design and construction will be undertaken by December 2022.

Following completion of the construction works, the Contractor will be responsible for providing warranty and Operations and Maintenance (O&M) services for three years.

The Council will not agree to any Contractor terms and conditions. The contract terms are non-negotiable.

Throughout this Specification and in line with the Contract 'Council' and 'Employer' shall mean Cheshire East Council.

The term 'Contractor' shall mean the persons, etc., whose quotation/tender is acceptable to the Council and shall include the persons, etc., legal representatives, etc.

This specification has been prepared by the Council as part of the tender pack. It may be the case that other issues arise either during or after the tendering exercise. The Council reserves the right to amend the specification as appropriate. Should the Contractor have any doubt as to the meaning of any part of the Specification, a clarification must be submitted to the Client during the clarification period through the chest messaging function, in order that such doubt may be removed before the acceptance of the Tender. No claim based on the lack of information will be entertained

1.2 Site Overview

1.2.1 Leighton Grange

The site is an improved farmland which recently has been arable. The site is not contaminated and therefore piling will be allowed and the solar PV system must be mounted using this methodology. There is no public access to the site.

The Contractor must review the information contained within the Planning Decision Notice and planning conditions - this can be found in **Appendix 3**.

Indicative designs and feasibility assessments have determined that the site could accommodate a 5.4MWp solar farm – more detailed on the outline design can be found in **Appendix 1**.

The site has had a topographical survey done and the simplified 3D mesh model can be found [here](#) – please note this is for information only.

The site has also secured a provisional license for the Great Crested Newt – confirmation can be found below



DLL-ENQ-CHES-0009
5 - Provisional IACPC

2. Project Governance

2.1 Terms and Conditions

The installation and operation and maintenance contract will be based upon the Council's Design, Build, Operate and Maintain Contract, together with completed Schedules, Appendices and Special Terms (where applicable). The Contractor's final proposals and associated documentation will be bound into the contract agreement (the Contract) and will be supplemental to this specification.

The Council will not sign the Contractor's own terms and conditions and will not negotiate on any contract terms.

2.2 Contract Structure and Relationships

The Contractor will be contracted to the Council and will be responsible for managing the entirety of the project. As part of the Contract, they will have responsibility for appointing and managing all sub-contractors or organisations as necessary to complete the Works as outlined in Section 3. The Contractor will have responsibility for the costs associated with the involvement of all such parties. Such organisations may include but are not limited to the following:

- Design and Engineering Consultants
- Scottish Power Energy Networks (The District Network Operator)
- Mechanical and Electrical Equipment Suppliers
- Mechanical and Electrical Engineering Contractors
- Plant Hire Suppliers
- Grid Connection Test Consultants
- Legal Services

The Contractor will also be responsible for liaising with all statutory bodies and other organisations as required to obtain way leaves, access, consents or other agreements to execute the Works. The Contractor will have responsibility for the costs associated with the involvement of such parties. Such organisations may include but are not limited to the following:

- Local Authority Planners
- Scottish Power Energy Networks
- United Utilities
- Local Residents and Businesses
- In Vehicle Composting Facility, operated by Biowise

2.3 Management and Reporting

The Contractor will be responsible for reporting progress over the duration of the Contract in accordance with the following phases of development:

Survey and Design: At the end of this phase the Contractor will provide an updated programme / timeline chart and highlight any decisions that may be required from the Council. The Contractor will provide a weekly update to the Council during the design phase, an online meeting is acceptable, unless instructed otherwise.

Construction Phase: During this phase of the works, the Contractor will attend a weekly progress meeting to discuss health and safety, environmental management, coordination, progress and programme issues, and the forward plan of Works. The Contractor will also provide an updated programme / timeline and highlight any programme risks. It is expected that at least once per month, the Contractor will meet the team in person with the remaining meetings to run online (Ms Teams or equivalent platform)

Operations and Maintenance Phase: During this phase of the works the Contractor will attend quarterly review meetings and will provide quarterly improvement plans and provide monthly progress reports against those plans. Online meetings are allowed.

The Council will report progress to the internal Project Board and the Contractor may be invited to provide an update from time to time. This will be discussed and agreed 2 months in advance.

3. Scope of Work

The Contractor will be responsible for the design, supply, installation and maintenance of a working solar photovoltaic system (the 'Works') at the site as shown in **Appendix 1** and located at:

Leighton Grange
Middlewich Road
Leighton
CW1 4QQ

The Contractor's responsibilities will include all management, survey, design, construction, commissioning, operations and maintenance of a fully functioning PV system. The Contractor will act as the post contract Principal Designer and Principal Contractor as per the meaning and requirements set out in the Construction Design and Management (CDM) Regulations 2015. The Council will appoint a pre contract Principal Designer and CDM Advisor who will collate the Pre-Construction Information, submit the initial F10 and act as advisor post contract signing.

The specific Contractor's responsibilities will include but are not limited to the following activities:

- To comply with the standard working conditions, as specified by the United Utilities. These conditions can be found in **Appendix 5**;
- To comply with the specification from the Scottish Power Grid Connection offer. This can be found in **Appendix 2**

3.1 Site Access

Protection of roads, paths, and buried service crossings.

Compliance with working in close proximity of the United Utilities underground pipe (details in **Appendix 5**)

Welfare facilities.

Creating access ways and installing necessary site access gates and infrastructure.

Creating and improving access tracks.

Any additional site clearance works

3.2 Planning

Supporting the Council in the discharge of planning conditions (Planning documents can be found on the Planning Portal and the conditions are contained in **Appendix 3**).

The Contractor must review the information contained within the planning reports and planning conditions and design and construct the system in line with the information, advice and requirements.

Following Contract Award the Contractor will be required to support the Council in completing the Surface Water Management as per the Planning Conditions listed in Appendix 3.

3.3 Survey Works

Shading analysis survey.
Yield analysis
Geotechnical and ground conditions
Earth resistance survey
Cable route survey
Point of Connection (POC)
Transport and access survey

3.4 Design Works

All mechanical and electrical calculations and design works including:

- o Solar arrays, inverters, mounting systems
- o Transformers
- o RMUs
- o Substation and private wire
- o Switchgear and protection systems
- o Remote monitoring systems
- o Electrical earthing systems, surge protection and lightning protection
 - System yield calculations
 - Detailed design drawing production and version management
 - Obtaining detailed design approval from the Council

The design must have a performance ratio of 85% or above.

Indicative designs have been completed for the planning applications and the layout can be found in **Appendix 1**. The Contractor's design must be in line with these indicative designs to minimise the risk of requiring additional/new planning permission. The Contractor will support the Council in submitting any requests for non-material amendments to the Local Planning Authority. The planning risk for changes in the design will lie with the Contractor.

3.5 Construction Management

Project management and site supervision
Programme management and reporting Health and Safety (H&S) management
Construction site security
Welfare facilities
Traffic and deliveries management
Environmental management and monitoring
Waste management, recycling and disposal
Making good any damage resulting from construction activities
Drainage calculations to ensure adequate surface water management.

3.6 Construction

Array construction, including but not exclusive of:

- o Module mounting system

- o Modules
- o DC cabling
- o DC isolators
- o Combiner boxes
- o String fusing where applicable
- o Surge protection
- o Lightning protection

AC systems installation, including

- o Inverters.
- o AC cabling
- o Isolators
- o AC distribution boards
- o LV protection systems.
- o Surge protection.
- o Energy metering

Earthing systems.

Lightning protection systems.

SCADA enabled web-based monitoring system.

Please refer to the full scope of construction works itemised in section 5 for more details

3.7 Electrical Connection

Non-contestable works to Point of Connection.

All condensable works, as per the grid connection offer (**Appendix 2**) to be delivered, in line with specification from Scottish Power Energy Networks.

The Employer assumes responsibility for the Point of Connection as specified in the Grid Offer Agreement (**Appendix 2**) and requires the Contractor to adhere to the SPEN specification.

3.8 Commissioning and Handover

Mechanical and electrical inspection and test reports.

Private wire testing and commissioning

Grid connection testing and certification in line with G99 requirements.

Provisional, Intermediate and Final Acceptance certification

Liaison with Council's Technical Advisor

Building control approvals if required

Handover documents and drawings.

3.9 Planning Conditions

Meeting and discharging all Local Authority planning conditions. List of planning conditions have been attached in **Appendix 3**

3.10 Operations & Maintenance (O&M)

Procurement and storage of essential spares (if required).

Remote system monitoring and reporting.

Planned maintenance management and delivery.

Reactive maintenance management and delivery.

Array cleaning.

Grass cutting and vegetation management.

Maintenance management of boundary fencing and CCTV

3.11 Warranty

Provision of a minimum 24-month Contractor's warranty covering all materials and workmanship.

Provision of transferable module product and performance warranties.

Provision of transferable manufacturer warranties for inverters, switchgear, and mounting system.

Any other relevant product warranties.

3.12 Consents

Complying with Scottish Power Energy Networks (DNO) requirements.

Complying with United Utilities requirements

Obtaining Building Control approvals where required.

4. Site Survey and Design Works

4.1 Site Survey

All outline information provided in this specification is for guidance only and should not be used as the basis of detailed design work. The Contractor will be responsible for undertaking detailed site survey work as required to develop detailed designs. Survey work that may be required will include but is not limited to the list outlined in Section 3.3.

Upon completion of surveys the Contractor will provide the Council with a summary of the survey findings and highlight any recommendations or concerns; proposals to mitigate such concerns should be presented and explained.

4.2 Solar PV Design Works

The Contractor will be responsible for all detailed mechanical and electrical design work required to construct a fully compliant and operational system. An indicative design for the site has been completed for the planning application. The Contractor's designs must be similar in nature to reduce the risk of requiring new planning permission/multiple nonmaterial amendment approvals. The indicative designs enable battery storage to be retrofitted at a later date when it becomes more economically viable to do so. Contractors should not include battery storage in their design or costs but ought to consider future location of such a system, in the proposed layout.

The system size, DC and AC electricity output and performance ratio must be greater than or equal to that contained within the site's PV Syst energy yield assessment (**Appendix 4**). The performance ratio will be 85% or above. Please note that the indicative design is based on 450Wp panels and East West orientation.

The system design and installation will comply with the current version of the IET Code of Practice for Grid Connected Solar Photovoltaic Systems and other relevant specifications as listed in Section 17.

Biowise IVC facility will have an operational life of at least 35 years, therefore the PV systems should be designed to ensure this operational life can be attained. The design will utilise equipment which is supported by a manufacturer's after sales service in the UK. The Contractor must consider any changes that may occur over its lifetime including but not limited to environmental and grid connection, in its design. The position of the panels and associated infrastructure will not change over the lifetime of the system.

The Contractor will design while taking into consideration local site environmental conditions which may include but are not limited to:

- Wind speed
- Solar irradiation levels
- Precipitation
- Shading

The Contactor will design the scheme to optimise the system energy yield in terms of kilowatt hours generated per kilowatt peak of installed capacity when measured at the fiscal metering point whilst complying with Local Authority planning conditions.

The following (but not limited to) should be included/assessed during the design:

- Solar module power rating
- Low irradiance performance of the selected solar module. Module power mismatching
- Avoidance of significant sources of shading
- Module DC string layout and wiring efficiency
- System cable voltage losses
- Inverter-module string matching
- Inverter conversion efficiency
- Any other relevant site specific factors.

The Contractor shall be responsible for conducting the appropriate electrical studies and ensuring suitable protection settings are designed and installed as per the G99 requirements. The Contractor will be responsible for private wire electrical connection to the IVC facility.

The grid connection agreements allow for an import capacity of 650kVA. The Contractor will establish if this is sufficient to meet the auxiliary electrical demand from CCTV, lighting, ventilation, controls etc and propose alternatives if not.

The Contractor will include a method of distributing power to serve the local auxiliary loads in its design. Distribution circuits designed and sized according to the load and as per the standards set out in section 17.

All plant enclosures should be kept ventilated to an adequate standard for the correct operation of the equipment inside.

The Contractor will ensure that auxiliary systems have the required redundancy for systems which cannot be interrupted where required by the DNO.

All electrical studies and calculations should be included in the final design that is issued to the Council and its Technical Advisor for approval.

The system design should be reliable and minimise the risk of plant down time or risk of interruption to energy generation.

The system design should, where possible, eliminate or minimise construction health and safety risks. The Contractor shall ensure that all design work and processes comply with the Construction Design and Management Regulations (CDM) 2015. The project will be notifiable to the HSE and the Council will appoint the Contractor as Principal Contractor and post contract Principal Designer. The Council will appoint a Contract Principal Designer/CDM Advisor separately.

The system design should minimise environmental impact and should seek to minimise the environmental risks or impacts associated with construction and operation of the plant.

The design will seek to minimise transport requirements, remote sourcing and the unnecessary import and export of materials from site.

The Contractor shall satisfy itself that delivery routes and access for the delivery of materials shall allow optimum delivery vehicle sizes and adhere to any transport plans included in the planning application.

The design will consider decommissioning of the system and will facilitate the easy removal of materials from site whilst maximising the opportunity to recycle all materials recovered.

The Contractor will produce an energy yield assessment for their designs using PVSyst/PV Sol and as per those contained in **Appendix 1**. The output from this assessment will be used by the Council in its financial modelling and final business case. The Contractor should use the nearest MET Office weather station data in their calculations.

The system will be designed and installed in line with any requirements under the Renewable Energy Guarantee of Origin (REGO) scheme to enable REGO certificates to be issued to future energy suppliers. The Contractor will support the Council in all aspects of submitting an application to the REGO scheme.

The Contractor must take all relevant loads into account when designing the system. This should include but is not limited to:

- Wind loads
- Snow loads
- Uplift and horizontal forces
- Thermal loads
- Seismic loads
- Water loads
- Self-weight loads
- Ground stability; the maximum movement tolerated by the mounting structure shall be included in the design and the tilt angle must be maintained for the lifetime of the system.

The Contractor shall undertake pull out tests, and provide test results, to ensure that the mounting system remains fixed to the tree root mounting system.

A formal design review will be undertaken with the Council and their Technical Advisor. Design approval by the Council does not absolve the Contractor of their design responsibilities and the Council will not accept responsibility for any designs approved by them. No construction works or materials procurement will commence until the respective design for those works or materials have been approved in writing by the Council or approval is given by the Council to proceed in the absence of formal design approval.

Any decision to proceed with materials procurement or construction works without the Council approval will be at the Contractor's risk.

4.3 Civils Design Works

The Contractor shall complete relevant design work for the civils element of the construction works. The civils design should include but is not limited to:

- Any predesign site investigation works such as additional geo-technical/stability testing (see list of planning conditions in Appendix 3)
- Foundations for all permanent equipment and material
- Access roads
- Site preparation activities such as excavation, parking, setdown, craneage pads and storage (both during construction and at the operational stage)
- Trenching and ducting
- Landscaping and biodiversity undertakings and reinstatement of ground conditions after construction in accordance with the planning conditions and ecology requirements
- Drainage system if required
- Fencing and gating
- Construction of a substation for the DNO

The Contractor is responsible for the structural stability of the system. Foundations will be designed to withstand the site conditions for the lifetime of the project.

All relevant civil system calculations (including all load calculations), assumptions, characteristics, materials and specifications shall be provided to the Council to review.

4.4 Quality Assurance

Prior to equipment procurement and construction, the Contractor shall issue a Quality Control and Assurance plan for the project in line with ISO 9001:2015.

The plan should include details on but not limited to:

- Factory testing and inspection
- Method of visual inspection upon delivery of equipment/goods
- Method of testing a sample of equipment and materials upon delivery in accordance with the relevant standards to ensure they comply with the specification and required standards. This should include manufacturer's electroluminescence and flash testing of a sample of PV panels
- How defects will be recorded and managed.

The Contractor will provide a Quality Control and Assurance plan as part of its tender return.

5. System Construction

The design, construction and components of the solar system will comply with the following sections, and relevant British Standards (or equivalent recognised international IEC, ISO or other standards as deemed suitable) including but not limited to those standards listed in Section 17.

The Contractor will be responsible for the purchase of all equipment and goods required to implement its design.

5.1 Discharging Planning Conditions

The Contractor will have sole responsibility for discharging all planning conditions/SAB conditions stipulated by the Local Authority planning department/SAB in their Decision Notice. The Contractor should note that the Decision Notice may include works which are material to the project and which the Contractor will be required to include in their pricing and project programme. The planning conditions are detailed in **Appendix 3**.

5.2 Module Mounting System

The Contractor will supply a mounting system for the PV modules that:

- Is capable of supporting the solar modules securely for the lifetime of the scheme
- Uses the mounting system capable of supporting the modules for their lifetime

The mounting system will be procured with a minimum 10-year manufacturer's product warranty. The Contractor will not combine equipment from more than one manufacturer.

The Contractor will ensure that the mounting system is compatible with the proposed PV modules to be used for the project. Modules can be orientated in portrait or landscape format but **not** in a combination of the two and will comply with any height restrictions inherent in the planning application.

The Contractor will ensure that the mounting system is capable of withstanding the loads (static, snow and wind) that will be imposed on the PV modules and the mounting arrangements. The Contractor will be responsible for establishing the appropriate wind and snow class for this purpose and for carrying out all associated calculations. Dynamic effects from wind loading should be considered for the design of the mounting system and the fixings of the PV modules.

The Contractor will ensure that the mounting system is compatible with the site environmental conditions. Attention should be paid to corrosion resistance and to the long-term stability of the mounting system. The Contractor will ensure that adequate measures are taken to prevent galvanic corrosion between dissimilar metals. Where different metallic materials are used, insulating separators will be fitted to eliminate the risk of corrosion. All penetrations must be appropriately designed and protected to avoid corrosion and cable chafing. Cutting and drilling of mounting systems or site fixings that compromise the integrity of a galvanised steel corrosion protection system will be avoided where possible. If this is not possible then zinc protection paint will be applied to the cut surfaces.

The Contractor will demonstrate that the use of proprietary fixings has been reviewed and approved by the mounting system manufacturer. Brackets, clamps and supports will be designed, fabricated and installed in full compliance with the requirements of the PV module and the mounting system. Bolts, screws and nuts used for fixings will be of adequate strength for their purpose and will be high quality stainless steel. Nuts will be fully tightened after adjustment to prevent loosening due to movements and/or vibrations. The requirement for torqueing of bolts and nuts will be highlighted on the Contractor's drawings and tightening torque values are to be clearly stated.

The mounting system and its design will be capable of accommodating the thermal expansion, movement and temperatures to which it will be subjected to over the life of the project.

The Contractor will ensure that the mounting system does not represent a safety hazard in terms of exposed fasteners and sharp edges.

The Contractor will consider the decommissioning and removal of the system at the end of the project life and reinstatement of the site to its original state.

The Contractor will submit full design information including calculations to the Council and its Technical Advisor for review during the detailed design phase of the project.

5.3 Photovoltaic Modules

The Contractor will ensure that the PV modules are sourced from a Bloomberg New Energy Finance Tier 1 manufacturer and are of one model type only. The manufacturer should adhere to the requirements of the PV Cycle scheme or equivalent.

The PV modules can be mono-crystalline or poly-crystalline and must have valid current testing certificates to the following International standards:

- IEC 61730 - Photovoltaic (PV) module safety qualification – applicable to all module products
- BS EN 61215:2015 "Crystalline silicon terrestrial photovoltaic (PV) modules –

Design qualification and type approval" or BS EN 61215 – 1-2 Terrestrial photovoltaic (PV) modules. Design qualification and type approval.

The PV modules must have the following characteristics:

- Positive power tolerance either in terms of percentage or power rating in the range of 0 to + 3%
- The negative temperature coefficient of power for PV modules should be less than or equal to 0.45% per °C
- A suitable number of PV modules shall be connected in series strings. A suitable number of series strings shall be connected in parallel to formulate a series-parallel array
- The solar PV strings and array shall be designed to match the inverter input specification
- The maximum DC output voltage of the array shall not exceed 1500V

- The front surface of the module shall consist of impact resistant, low iron and high transmission toughened glass
- The module frame shall be made of corrosion resistant material electrically compatible with the structural material used for mounting the modules
- The solar PV modules shall come complete with solar cable connectors that meet international standards for module interconnection (MC4 or equivalent)
- Minimum design life of at least 25 years
- Minimum product warranty of 25 years for modules and 10 years for all other components
- Minimum linear power output warranty of 90% of the rated output after 10 years
- Minimum linear power output warranty of 80% of the rated output after 25 year
- Minimum snow load rating of 5,400Pa
- Minimum wind load rating of 2,400Pa.

Modules should be chosen with the intention of maximising the whole life energy output per kWp of installed capacity. Low irradiation characteristics and temperature performance should be considered in the selection process.

PV Modules will be transported and stored in accordance with the manufacturer's recommendations at all times. The modules will be able to sustain any temporary loading that may arise from lifting, storing, transporting, hoisting and installing them.

The solar PV modules electrical characteristics including current-voltage curves, and temperature coefficients of module power, voltage and current etc., shall be provided with the datasheets for the modules.

All relevant literature and technical information for the solar PV modules must be provided. This specifically includes: Voc, Isc, and Wp at STC conditions. The relationship between temperature and module output, I-V curves for 500, 700, 800 and 1000 W/m² solar input, physical size and weight and details of the materials used in construction, particularly backing material and encapsulation material.

5.4 Inverters and Electrical Systems

All electrical work will be designed and installed in accordance with the latest edition of all applicable codes, standards, and recommendations, including the IET Code of Practice for Grid Connected Solar PV Systems, BS7671 and the requirements of the network operator.

All inverters and PV strings should be physically numbered and referenced with permanent/durable signs. Each row should also be permanently signed for future reference.

5.4.1 Cables General Requirements

Low voltage AC and DC cable size and type, to be specified and supplied according to the guidance and requirements of IET 'Code of Practice for Grid Connected Solar Photovoltaic Systems' and BS7671. All LV cables will be BASEC approved.

Externally mounted cables will be installed using durable fixings that are resistant to UV radiation.

The Contractor must ensure cables are secure to reduce risk of theft. Cables must be ducted/trenched to a depth of at least 60 cm. Contractors must note the recommendations and information detailed in the land surveys when planning trenching work.

Design should protect the equipment from the livestock and sheep grazing.

Cables will be separated and laid out in cable trays where applicable and will not be bundled to reduce the risk of overheating.

Suitable Ground Fault Detector Interrupters (GFDI's) shall be incorporated either within the inverter or within the array combiner box.

String/Array combiner boxes shall be secured onto metal support structures.

The DC and AC cable type shall be PVC insulated, suitably armoured, grade multi-stranded aluminium or copper conductor sufficient for the maximum voltage incurred. Appropriate colour coding shall be used.

The DC and AC cables of adequate electrical voltage and current ratings shall be also rated for 'in conduit wet and outdoor use'.

All cables supplied must conform to the requirements of UL4703 or TuV standards for the use of Photovoltaic systems. All DC cables must be single core double insulated solar cable with a voltage rating appropriate for the maximum Open Circuit DC voltage of the string it is a part of.V.

The DC and AC cable size shall be selected to maintain losses within specified limits over the entire lengths of the cables.

- o The total DC cable losses shall be maximum of 3% of the plant rated DC capacity over the specified ambient temperature range as per IET code of practice.
- o The total AC cable losses shall be maximum of 3% of the plant AC output over the specified ambient temperature range as per IET code of practice.

All cable conduits shall be GI/HDPE type.

All cable trays shall be either powder galvanised steel, galvanised steel or aluminium.

An external G99 disconnection relay(s) must be provided to protect the grid and PV system from irregular AC power characteristics.

5.4.2 DC Cables

All cables and their connectors routed behind the PV modules must be rated for a temperature range of at least minus15 to plus 85 degrees centigrade (ambient) and plus 105 degrees centigrade (operating).

DC cables will be double insulated with cross linked, thermosetting insulation and be sized to ensure compatibility with the dimensional requirements of the connector system used.

DC cables are to be sized such that the overall voltage drop between array and inverter is less than 3% at maximum operating power.

Array string cables are to be terminated in junction boxes and/or DC isolators correctly rated for voltage, UV stability and ingress protection and must be uniquely identified using lightfast permanent labels.

All DC component ratings (cables, isolators/disconnectors, switches, connectors, etc) of the system must be derived from the maximum voltage and current of the PV array. This must take into account system voltage/currents of the series/parallel connect modules making up the array. It must also consider the maximum output of the individual modules

DC cables should be suitably supported and clipped along their length, without leaving any sections vulnerable to snagging or catching on personnel or plant when above ground.

Alternatively, they should be protected as follows:

Thermoplastic (PVC) ducts shall be unplasticized Thermoplastic (PVC) pipe complying either with BS 4660 or BS 5481 as appropriate, or with BS 3506 classes B, C, D or E.

String/Array combiner boxes shall incorporate DC string circuit breakers, DC array disconnect switches, lightning and over voltage protectors using screw type terminal strips and strain-relief cable glands.

5.4.3 AC Cables

The Contractor shall determine the appropriate cable type and size as part of its design.

All HV/LV AC cables will be sized to satisfy no more than a 5% volt drop between the inverter terminals and the point of connection.

AC distribution/combiner boxes shall incorporate AC circuit breakers, surge voltage protectors, any other protection equipment, screw type terminal strips and strain-relief cable glands

5.4.4 Overvoltage and Lightning Protection

The Contractor will carry out a risk assessment for the lightning protection system and install adequate protection as required for insurance purposes and in accordance with BS EN 62305.

The lightning protection system will protect all inverters, control and monitoring systems and any other electrical and mechanical equipment against lightning strikes and will have adequate surge protection.

The Contractor will submit proposals for ensuring adequate design against lightning strikes and induced overvoltage risk to the Council for consideration.

5.4.5 Earthing

The Contractor is responsible for ensuring that the provision of earthing to the site meets the relevant standards and complies with the requirements of the DNO. This should be designed in order to withstand the highest leakage and earth fault currents foreseeable.

The Contractor should consider the durability of the material underground and with limited maintenance.

5.4.6 Duct sealing and stopping of penetrations

All cable ducts will be sealed so as to prevent the ingress of foreign bodies and infestation by rodents. Such sealing must facilitate subsequent cable replacement as may be required.

Any penetrations through structures should be sealed appropriately. Penetrations through fire-rated partitions must be fire stopped in accordance with the relevant standard.

5.4.7 Inverters

The Contractor will provide an inverter arrangement that is selected to give optimal energy yield from the plant over the r lifetime of the installation taking into account the site conditions and the proposed module layouts and orientations.

The Contractor will submit proposals of preferred inverter selection, including sizing calculations, specifications and data sheets. These will demonstrate electrical compatibility between inverters and modules including, appropriate inverter dimensioning and ensuring system voltages are within acceptable Maximum Power Point Tracker (MPPT) ranges across the extent of operating conditions for the system.

The indicative design has assumed that centralised inverters will be used. The Contractor must clearly set out its reasons for using string inverters over centralised.

The inverters will:

Comply with all relevant standards and codes of practice.

Comply with Electricity Networks Association (ENA) G99 standard requirements and carry a Type Test certificate to the requirements of G99/1.

Incorporate the facility to isolate DC strings on or immediately adjacent to the inverter (if string inverters are proposed).

Incorporate string fuses/circuit breakers if required and if not included in combiner boxes or elsewhere in the DC circuit.

Incorporate the facility to lock off the DC and AC supplies for maintenance purposes. Be equipped with surge protection devices for both the AC and DC circuits.

Have multiple MPPTs in order to minimise the impact of shading on arrays when required.

Incorporate a monitoring function that includes time and date, power output, fault codes and operating status which can be viewed on a user interface and through a remote web portal/3rd party software.

If located outside be IP65 and UV rated and suitable for external mounting in local environmental conditions. All inverters will be at least IP54 level protection even where the inverter is stored in a container. Provide an efficiency of at least 96% at full load operating condition. Be connected to the main earthing system of the electrical distribution network. Be supplied by a single manufacturer.

Be provided with a minimum 10 year manufacturer's warranty.

If the inverters are to be enclosed in cabinets, the inverter cabinets must be appropriately rated and the inverters must be compatible with the environment expected at the site. The cabinets shall be designed for operation with natural cooling as far as possible. If cooling by forced convection is required, at least two (2) numbers of ventilation fans each rated at 100% of the required capacity shall be provided. The ventilation fans shall be equipped with monitoring, control and alarm signals.

The inverters shall provide display of Time, PV array DC voltage, current and power, AC output voltage and current (All 3 phases and lines), maximum AC power generated and Instantaneous Power (Active, Reactive and Apparent), Power Factor (All 3 phases and cumulative) and frequency. Remote monitoring of inverter parameters must be possible to connect to the solar PV system.

The solar PV system shall have a lagging power factor greater than 0.9 when the output is greater than 50% of the rated inverter output power.

The inverter system shall include DC ground-fault protection, which must disable the solar PV module in the event of a short-circuit to ground on the DC input of the inverter.

The inverter shall be provided with a clearly marked isolator for maintenance / emergency shutdown.

Independent of whether a multiple string inverter solution is provided or a central inverter solution, data must be provided for all DC strings connected to the inverters. The Contractor must justify their choice of inverter design in their proposal.

Inverters must be supplied by a recognised manufacturer who is able to provide after sales services and support in the UK.

5.4.8 Labelling

All exterior mounted signs and labelling will be of robust UV stable design suitable for outdoor use.

Specific signs and labels will be applied as specified in the IET 'Code of Practice for Grid Connected Solar Photovoltaic Systems'.

DC specific hazard labels should be located at no more than 5m intervals on surface cable runs and with a clear view from one label to the next.

All labelling will match as built drawings.

5.5 Transformer

The transformers must be sized to transform the maximum power that the inverters are capable of delivering across the inverter operational design range, whilst minimising losses. For oil filled transformers, oil shall be accessible for sampling without compromising the warranty of the transformer.

Oil tests shall be conducted after start of operation and before PAC in order to benchmark the oil quality at start of operation;

Distribution and auxiliary transformers shall be sized to be able to operate at maximum generation/load;

All transformer instruments shall be able to be replaced without the need to drain oil;

An oil catch bund shall be big enough (by a factor of at least 1.2) to be able to capture all leaked oil in case of a failure;

It shall be possible to mount or dismount cables from the transformer cable boxes;

A five-step off-load tap changer (+/-10 x 2.5%) with manual drive mechanism shall to be provided;

Indoor transformers shall be separated from inverters and switchgear;

5.6 Switchgear/RMUs

The switchgear shall be able to appropriately protect inverters and/or transformers;

The switchgear shall be composed of a Ring Main Unit (RMU) to protect each branch of the solar park (cables, inverters and transformers);

The Contractor shall install HV Switchgear immediately downstream of the power step-up transformer, the Switchgear will consist of:

One HV circuit breaker or switched fuse for protection of the LV/HV power transformer,

Two circuit breakers or two on-load switch disconnectors for the connection to the internal plant HV network;

Each switchgear unit shall be provided with ground switching devices and shall be equipped with key interlocks;

Each switchgear unit shall be provided with diagrams and instruction for switching operations;

All HV switchgear shall have at least the following characteristics:

- Gas or air insulation with appropriate gas leak detection if gas insulation is specified,
- Indoor,
- Be controlled with interlocking keys,
- Have all the necessary control relays and measuring/metering devices;

Circuit breakers shall be able carrying and breaking currents under normal and abnormal conditions;

The switchgear shall be of proven design and have all necessary tests taken;

The HV circuit should allow the operator to isolate sections of the solar farm, minimizing downtimes during maintenance and repair for unaffected areas;

5.7 Substation Construction

The Contractor shall construct the substation in line with the requirements of SP Energy Networks; the District Network Operator (DNO), should an Independent Connections Provider (ICP) be employed as a subcontractor for the contestable works elements.

The substation should meet the requirements of the SPEN as specified in enclosed 'Substation Guidance 3 panel board'



Substation Guidance
3 panel board.pdf

5.8 Grid Connection

Grid connection will be via highlighted point(s) of connection detailed on the Grid Connection Offers (**Appendix 2**).

The Contractor is responsible for liaising with SP Energy Networks on all grid connection related matters and as per the G99 requirements, including the witnessing of G99 relay function and sign off where required by the DNO.

The Scheme is also to be connected to the IVC facility substation, utilising private wire arrangements and behind the meter generation.

5.9 Controls and Monitoring Systems

The Contractor will provide a control and monitoring system for the installation to be housed in a control room or a kiosk. The control and monitoring system will be used by the O&M provider who will have responsibility to provide the following services as part of their contract:

- Continuous monitoring and logging of plant operation and performance.
- Logging of system faults.
- Flagging of alarms via SMS and/or email to the System Operator.
- Provision of data logging and display.
- Regular reporting of key performance indicators as required by the Council

The control and monitoring system will compile instantaneous values of system performance and will make this data externally available for remote access. The system will be capable of automatically raising an alarm if communication is lost between the site and the remote monitoring facility. The system should be able to take at least the following inputs:

- String current.
- Where applicable; DC and AC combiner box/inverter DC inputs/Inverter modules current, voltage and power.
- Readings from the site installed pyranometer and weather station.

- Other inverter parameters such as fault codes, operational state, temperature etc.

The control and monitoring system will allow the O&M provider and the Council to access all information regarding the status of the system at any time and to detect operational faults at an early stage. In the event of a fault the system will send text messages and/or emails to associated operators. It should be possible to compare the yields of strings and inverters in the plant allowing detection of significant deviations.

The control and monitoring system will be capable of compiling and sending individual yield and event reports via email to the O&M provider and the Council. Information concerning the performance of the solar power plant will be accessible to the Council via standard web browsers. Web pages will update correctly without the requirement for any additional software to be installed on the Council's system.

The monitoring system should show live data which can be graphed and should have the ability to create automatic reports.

The monitoring system will be able to distinguish between loss of communication and shutdown and should have a battery to enable data transfer even in the case of full plant shutdown.

The Contractor will obtain all licences, permissions, copyright waivers and rights of use of software on behalf of the Council. The Contractor will ensure that the Council is registered with software suppliers and provided with appropriate support and software updates. The Contractor will seek approval from the Council before the application of any proprietary software.

The selected meters must be certified in accordance with The Electricity Act (Schedule 7), meters should also be approved under the European Measuring Instruments Directive (MID). MID approved meters must meet the Measuring Instruments (Active Electrical Energy Meters) Regulations 2006.

The meter should comply with all current UK and European Standards including:
BS EN62052-11:2003 Alternating current static watt-hour meters for active energy (classes 1 and 2)

BS EN62053-21: 2003 Static Meter for active energy (class 1 and 2)
Operating temperature range -20°C to +40°C.

SI1566:1998 The Meters (Certification) Regulations 1998.

The meter should be tamper proof i.e. every reasonable step should be taken to prevent unauthorised intervention, in line with industry best practice.

5.10 Weather station

The site weather station at the site must contain an anemometer, 2 ambient temperature sensors (one in free air and the other positioned on a panel surface) and a wind vane.

Each site will have 1 tilted pyranometer (Kipp & Zonen SMP10/11 or equivalent) at the same azimuth and angle as the solar PV panels. The Contractor shall highlight if additional pyranometers are required in its tender return. All pyranometers shall be free of shading.

5.11 Site Infrastructure

The Contractor will be responsible for designing, constructing and maintaining all temporary and permanent infrastructures as required to support the site construction and on-going operation, including but not limited to the following:

Road traffic signage.

Access gates and fencing arrangements

Service bridges to eliminate damage to existing buried services.

Set down, plant and equipment storage hard-standings.

Site security fencing.

Project management office (if required).

First aid facilities.

Safety barriers and signage.

There are number of access points at the site which will need to be secured during the construction phase.

Indicative fencing designs are included in **Appendix 1**. The Contractor will ensure that this fencing is appropriate and secure and suggest alternatives where applicable.

The security system will be in accordance with insurance requirements and any planning conditions. The system installed must either be, or be able to fully interface with Dahua and their video management system.

Cameras shall be in infra-red to ensure visibility during night and day and will be installed to prevent blind spots, considering the topography of the sites.

The contractor will install all necessary signage relating to CCTV and the installation on the fencing and relevant structures.

5.12 Decommissioning

Systems will be designed for ease of future deconstruction and recycling and will be designed for disassembly with an associated end of life waste management plan.

6. Tests on Completion

All tests will be over seen and evaluated by the Council's Technical Advisor to ensure the testing requirements are met.

6.1 General Tests Protocols and Requirements

6.1.1 Instruments used for tests

The site pyranometers shall be used to measure irradiation for all testing and performance calculations. To measure the electricity generated and exported appropriate generation/import/export meters shall be installed which will be MID approved.

6.1.2 Test Pre-requisites

The following must be completed before each of the tests may commence:

The PV System is to be electrically and mechanically complete, except for minor punch-list (snagging) items approved by the Council and its Technical Advisor, at its sole discretion, that do not affect the PV System's safety, operability or reliability.

Grid Connection is achieved and G99 certificate issued.

The monitoring system is to be complete and running and the PV System is able to be monitored remotely.

All inverters are operating in accordance with the manufacturer's specifications and are calibrated and communicating properly with the PV System monitoring system.

Isolation testing has been completed successfully. All cables (between boards and ground) have been checked for proper isolation according to applicable UK Electrical Regulations.

String level DC (voltage, current and insulation resistance) testing has been completed successfully. All generation equipment has had pre-start testing completed in accordance with manufacturer's specifications.

The meteorological stations and Reference Cell are operating and their signals are capable of being monitored by the PV System monitoring and control system.

Preliminary testing under load has been performed successfully.

LV, HV and MV electrical system checking has been successfully completed to applicable UK regulations.

All requirements under the Renewable Energy Guarantees of Origin Scheme have been met.

Such other test pre-requisites, if any, as may be specified by law have been completed.

6.1.3 Testing Protocol

The Contractor shall submit a proposed testing protocol to the Council and its Technical Advisor for review and approval not later than five business days prior to the scheduled commencement of any tests. The testing protocol shall comply with all requirements contained in this specification.

The Council and its Technical Advisor shall review the Contractor's proposed testing protocol and provide comments to Contractor within five (5) Business Days after receiving it from the Contractor.

If the Council or its Technical Advisor provides comments, the Contractor shall revise its proposed testing protocol to address the Authority's comments and re-submit it for review and approval within three (3) Business Days thereafter.

The Council shall notify the Contractor in writing when its proposed testing protocol is acceptable.

When the Contractor has completed all test pre-requisites specified above, the Contractor shall notify the Authority in writing. The Contractor's notice shall identify each Test pre-requisite and provide adequate supporting information documenting completion of the corresponding requirements.

The Council shall review the Contractor's submission and notify the Contractor in writing whether or not all test pre-requisites have been satisfied. If all test pre-requisites have not been satisfied, commencement of the tests shall be deferred until all test pre-requisites have been satisfied or the Council, in its sole discretion, has approved commencement of the tests.

Not later than five (5) Business Days prior to commencing any test, the Contractor shall notify the Council in writing of the specific date and time for commencement of such test. If the Contractor fails to timely provide any of the required notices, commencement of the corresponding tests shall be deferred until the required notice periods are met or the Council, in its sole discretion, approves commencement of the subject tests.

6.1.4 Availability of Required Documentation

Prior to commencing any tests and subject to the specific document requirements at Provisional Acceptance, the Contractor shall have provided the Council with one copy of, and shall have available at the Site two copies of, the following documents:

Approved Test Protocol.

Contractor notice of satisfaction of all Test pre-requisites. Plant

Engineering Documentation:

As built drawings and complete engineering design package.

Instruction manuals for all equipment.

Flash test reports for all Modules, identified by Module serial numbers (in Excel format).

Inverter Documentation:

- Certification documentation for all inverters, identified by serial numbers.
- Identification of all inverters in the PV System, including the cluster of panels ('**Block**') to which each inverter belongs.

Instrumentation Documentation:

- Calibration documentation where appropriate for all instruments installed in the plant, including current meters, voltage meters, energy meters, meteorological instruments, etc.
- Identification of instruments in the PV System, including the Block to which each instrument belongs.

Monitoring and Control System Documentation:

- Test Instrumentation and Calibration - where appropriate.

The Contractor shall provide the test data specified in this specification for all tests.

The Contractor shall certify to the Council in writing that the test results and supporting data provided by the Contractor are complete, current and accurate.

Within five (5) Business Days following receipt of all required test results, supporting data and Contractor's certification of the test pre-requisites, the Council shall notify the Contractor in writing that the test results submitted by the Contractor are either accepted, rejected or incomplete following review by the Technical Advisor. If the Test results are rejected, the Council shall provide the basis for rejection. If the test results are incomplete, the Council shall identify the missing information. Within five (5) Business Days following receipt of the missing information, the Council shall notify the Contractor in writing that the test results submitted by the Contractor are accepted or rejected.

If the Council rejects any test results submitted by the Contractor, the Contractor shall repeat the applicable test in accordance with the testing protocol and all applicable provisions of this Agreement.

6.2 Works Acceptance Tests

6.2.1 Overview

The Works Acceptance Tests comprise Visual Tests and Functional Tests which must be carried out in accordance with this schedule and IEC 62446-1-2016 "Grid connected photovoltaic systems - Minimum requirements for system documentation, commissioning tests and inspection"

6.2.2 Visual Tests

The objective of the Visual Tests is to check that:

components are free of visible damage that might affect the safety of the component and of personnel;

components have been installed properly;

appropriate Materials and proper installation methods have been used that are suited to the environment in which the components are installed;

components are readily accessible for the operations of the operations and maintenance contractor;

the electrical installation of the PV System has been carried out in accordance with the Design and the Council's requirements;

the installation and calibration of all protection and signalling equipment is completed and ready;

electrical drawings, safety and operating manuals are ready, taking into account the fact that at the time of the Provisional Acceptance Test the Contractor is not obliged to provide the full maintenance manuals;

fuses, breakers, circuits, connectors etc are correctly labelled and identified; cables and boards are correctly and clearly labelled;

all electrical connections are made-off and completed correctly;

components have been installed fully in accordance with manufacturer's instructions; all

necessary protection against electrical shocks due to damage to insulation of

active (indirect contact) is in place;

factory test reports/electroluminescence flash testing or quality test reports from the manufacturer have been supplied when applicable.

Visual Inspection Tests are to be carried out on all components belonging to the PV System, including the Grid Connection line. The following parts as a minimum shall be subject to visual inspection: inverters; foundations; structures; photovoltaic modules and DC installation; pits, cabling, electrical boxes and protection devices; internal connections and interconnections with external installations; monitoring system; low voltage installation, including protection equipment and utility interconnection equipment; medium voltage installation, including transformers, protection equipment and utility interconnection equipment; surveillance (CCTV) system; grid connection line.

6.2.3 Functional Tests

The following aspects shall be subject to functional test:

- the electrical continuity and the connections between PV modules;
- the AC/DC conversion system (inverters) with reference to the use and maintenance manual;
- the control and supervision system (where applicable);
- the grounding of MW block substations, dischargers and lightning rods; the insulation of electric circuits and earthing circuits;
- G99 control equipment and relays;
- testing of electrical equipment and earthing systems to ensure conformity with applicable UK regulations.

6.3 Provisional Acceptance Tests

6.3.1 Conduct of Acceptance Tests

The Council, the Contractor and the Technical Adviser shall each appoint a representative responsible for representing them during the conduct of the Acceptance Tests and each shall be provided the opportunity to witness all tests. The Council shall give reasonable notice to the Contractor that other interested parties will be witnessing the tests and the Contractor shall provide such facilities and support as the Council, the Technical Adviser and their respective representatives reasonably require to witness the tests.

The Contractor shall be responsible for safely conducting all tests and will provide a safety briefing for all personnel. The Contractor shall discontinue performance of any tests in the event of any unsafe conditions.

Before commencing the tests, the Contractor shall submit for the Council's review and approval its proposed testing protocol and all performance tests shall be performed in accordance with the testing protocol approved by Council.

Weather conditions must be suitable for obtaining usable results from the tests and all other pre-requisites in this schedule must be satisfied.

During the Acceptance Tests all incidents shall be recorded in a test log book and the following data shall be recorded for each Block:

- energy output
- module temperature;
- irradiation in plane of PV Modules

- ambient temperature;
- IV Curve report.

The Acceptance Tests period will conclude with a review meeting. If unsatisfactory test results are obtained, this meeting will be used to determine the course of action required to obtain satisfactory results.

Processed data shall be prepared in a spread sheet in a form reasonably acceptable to the Technical Advisor.

6.3.2 Procedures for stopping and starting the tests

If during an Acceptance Test an event beyond the control of and not the fault or responsibility of the Contractor causes the PV System or a part thereof to stop operating or to be disconnected temporarily, then the Acceptance Test shall be suspended during the period of non-operation and, following restoration of operation, the Acceptance Tests for the PV System or Block (as the case may be) shall resume for the remaining period until the Acceptance Tests have run for the required period.

The Contractor shall maintain a log of any such event, including the cause, duration and times at which the Performance Testing was suspended and resumed.

The Contractor shall provide written notice to the Council within twenty four (24) hours following each such test suspension and resumption. Tests may only be resumed if the test pre-requisites specified in this schedule remain satisfied.

If the Contractor determines that it is unlikely to pass a test, the Contractor shall notify the Council and may discontinue performing such test. The Contractor may subsequently commence a new test, subject to compliance with the procedures in this schedule.

6.3.3 Performance Ratios

The Performance Ratio (PR) is a measure of the quality of the design and the components of the Plant. It is the relationship between the actual energy measured at the export meters, (E_{prod_n}), and the energy theoretically produced by the Modules (before cabling and inverters), E_{pv_n}

The PR is calculated as follows:
$$PR_n = \frac{E_{prod_n}}{E_{pv_n}}$$

E_{prod_n} is the sum of all available energy produced by the Plant during the Provisional Acceptance Test period as measured at the OFGEM approved export meters.

E_{pv_n} is calculated from the nominal performance of the Module and the average output from the on-site pyranometers which measure irradiation during the test period being 10 days. Each sampling period, j , will have a duration of 15 min. The export data will be sampled in 30 minute periods.

In measuring the irradiance, the pyranometers will measure irradiance averaged over thirty minute periods, and the resultant irradiation values shall be adjusted to exclude periods during which the actual production of the Plant has been reduced due to reasons not attributable to the Contractor, resulting from:

- a) an Excluded Defect;
- b) an Event of Force Majeure;
- c) failure by the Employer to perform any of its obligations under the Contract (which for the avoidance of doubt is not attributable to any act, default or negligence of the Contractor, its employees, agents and Subcontractors) or due to any act of prevention by the Employer or due to delays, actions or omissions of the Employer (save where the Employer is exercising its rights under this Contract), or any third party to whom the Employer grants access to the Plant (which for the avoidance of doubt shall not include Affiliates of the Contractor, the Contractor's personnel or Subcontractors), where they are not operating under the instruction of the Contractor;
- d) any failure by the DNO or the Meter Operator Contractor properly to have performed any of the Excluded Works;
- e) the inverter not being operative due to a cause solely attributable to the Employer;
- f) examinations or assessments are carried out by authorities or the Employer;
- g) the inverter not being operative due to any improper use or mishandling of the Plant by the Employer or any third party (other than the Subcontractors, any Affiliates of the Contractor or the Contractor's personnel) or any operation and/or repair or maintenance by a person other than the Contractor, the Subcontractors, any Affiliates of the Contractor or the Contractor's personnel (save where the need for the same arises from any breach of this Contract by the Contractor);
- h) any addition to, modification, movement or replacement of the Plant or any of its Component Parts which has not been carried out, or approved in writing, by the Contractor its Subcontractors, any Affiliates of the Contractor or the Contractor's personnel (save where the need for the same arises from any breach of this Contract by the Contractor);
- i) the Plant has been shut down because due to ambient temperatures below -25 degrees centigrade or above 60 degrees centigrade;
- j) unavailability of the grid connection;
- k) the Plant operating under G99 / G100 constraint including when the power factor is changed; and
- l) during the performance of Acceptable Maintenance Activities.

The energy generated during these periods will also be excluded from the calculation.

Irradiance shall be measured in the same plane as the photovoltaic array by on-site pyranometers which have been installed correctly and are suitably calibrated.

If, during the Provisional Acceptance Tests, there are gaps in the recorded irradiation data, then the testing period shall be restarted so that subject to the Procedures for Stopping and Restarting Testing (as set out below) the total analysis period, n , with associated irradiation data will equal 120 continuous hours.

E_{prod_n} is calculated by summing the energy generated during each sampling period from $j=1$ to $j=240$:

$$E_{prod_n} = \sum_{j=1}^x E_{prod_j}$$

Where:

E_{prod_j} =Energy measured at the approved export meters in timeframe, j (kWh)

E_{pv_n} is the energy theoretically produced by the modules during the testing period. This includes the summed irradiation from $j=1$ to $j=240$:

$$E_{pv_n} = \frac{P_{Nom} * \sum_{j=1}^x H_j}{G}$$

Where:

- P_{Nom} = Nominal peak power of the modules in Standard Test Conditions, kWp
- H_j = average of the irradiation hitting the Modules in timeframe j, kWh / m²
- G = Irradiation under Standard Test Conditions = 1 kW / m²

The PR value from the testing period is then adjusted to account for variation due to temperature using the monthly correction factor (table below). The result of this adjustment is the PR result.

$$PR_{PAC} = \frac{PR_{\tau}}{FMI}$$

Where:

- FMI = month factor, as applicable depending on the relevant month as shown in the table below. The adjustment will be weighted to take account of the number of days of the test that falls in each month e.g. if 2 days of the test fell in August and 8 days in September the factor would be (0.20*August correction factor)+(0.80*September correction factor)

6.4 Tests on Completion – Remedial Works

Upon completion of the Tests on Completion, the Council will issue the Contractor with a schedule of remedial works which the Contractor will rectify prior to the issue of the Provisional Acceptance Certificate.

7. Warranty and Operations and Maintenance

7.1 Warranty Cover

The Contractor will determine and provide details of their workmanship and equipment warranty durations and conditions as part of their proposal as indicated below:

A minimum 24-month Contractor's workmanship and materials warranty.

Modules: minimum manufacturer's linear performance warranty of 80% of rated output after 25 years.

Modules: minimum manufacturer's product warranty of 25 years.

Inverters: minimum manufacturer's product warranty of 10 years.

Mounting systems: minimum manufacturer's product warranty of 25 years.

Transformers and RMUs: minimum manufacturer's product warranty of 10 years.

Combiner boxes: minimum manufacturer's product warranty of 2 years.

Transferable manufacturers product warranties for other components which may include:

- o LV switchgear
- o Protection systems
- o Metering
- o DC and AC cabling
- o Electrical enclosures

During the Contractor's Workmanship and Materials/Operation and Maintenance warranty period, the Contractor or its Sub-Contractor will be responsible for undertaking all repairs and reactive maintenance work including the supply of all materials, parts, labour, subcontractors, plant and test equipment as necessary to maintain the efficient, safe and normal functioning of the system.

Six months before the end of the Workmanship and Materials warranty the Council together with the Contractor will undertake a detailed inspection of the equipment. Following completion of the inspection the Council will produce a warranty snagging list which the Contractor will incorporate into the maintenance plan for completion before the end of the warranty period.

On completion of the Workmanship and Materials warranty period the Council will undertake a final inspection of the plant to ensure that all previously identified warranty issues have been rectified by the Contractor. Regardless of the end of the Workmanship and Material warranty, the Contractor will have responsibility for completing all warranty works which were identified during the warranty period and all such works will be completed at the Contractor's expense.

7.2 Operations and Maintenance (O&M)

The Contractor will be responsible for the full O&M of the plant for the three-year. Workmanship and Materials warranty period following the formal handover of the finished installation. The Contractor's maintenance plan will ensure reliable and safe operation of the plant whilst maintaining asset value and performance. The Contractor will provide details of

their proposed maintenance plan for the first three years as part of their tender proposal and will include the following minimum requirements:

Procurement and storage of essential spares

Remote plant operation and performance monitoring.

Planned preventative maintenance and delivery in accordance with manufacturer's requirements to achieve an availability guarantee of 99%.

Reactive maintenance services.

Grass cutting and vegetation/weed management as per the biodiversity management plan.

Fencing repairs.

Full warranty management

Implementation and management of agreements with 3rd parties requiring access to the site if applicable.

The Contractor's O&M obligations will be fully inclusive and will include but will not be limited to the following:

- Labour
- Sub contracted services
- Materials
- Replacement parts
- Transport and freight
- Plant and equipment hire

The Contractor will provide the Council with their proposed response times as part of the tender proposal. The minimum response times will be as follows:

| Service Area | Service | Response time |
|----------------------------------|---|----------------------|
| Plant Outages | Reporting outage | 60 minutes |
| | Attendance at site | 12 hours |
| | Labour and/or parts repairs (on site spares) | 24 hours |
| | Labour and parts repairs (excluding long lead time items) | 72 hours |
| Reduced Energy Generation | Reporting reduced output / inverter failure | 12 Hours |
| | Attendance at site | 24 hours |
| | Labour only repairs | 48 hours |
| | Labour and parts repairs (on site spares) | 48 hours |
| | Labour and parts repairs (excluding long lead time items) | 1 week |

The Contractor's O&M obligations will exclude damage and remedial works arising from:

- Acts or omissions by the Council or their staff or agents
- Civil unrest

- Acts of terrorism
- Direct lightning strikes
- Damage from fire originating outside of the plant boundary and outside of the Contractor's control

The Contractor shall hold a stock of spare parts for the Operation and Maintenance period.

The spare parts should include:

- Solar PV panels
 - Inverters and associated spare parts (depending on whether centralised or string inverters are used)
 - Mounting structure parts
 - Fuses and combiner boxes
 - AC, DC and communication cable
 - Connectors
- Any other site consumables

The Contractor will provide an annual report within 14 days of the end of each anniversary year which will include the following:

1. Solar plant percentage uptime
2. Energy generated by month against predicted yield
3. Energy generated in year against predicted yield
4. Solar plant capacity factor in year to date
5. Details of planned maintenance undertaken during year
6. Details of reactive maintenance undertaken during year
7. Details of any spare components utilised (if relevant).

The Contractor will provide quarterly improvement plans and provide monthly progress reports against those plans.

7.3 Biodiversity Management Plan

The Contractor will work in partnership with the Council and the Council's Ecologist to develop the management plan.

The following are likely outcomes/requirements that will be detailed in the final management plan:

The management of the existing grassland for biodiversity and maintaining rabbit grazing under and adjacent to the panels. Existing good pollinator habitats are to be maintained. Weed management of Ragwort as per the Code of Practice Management of edge habitat and promoting scrub growth along fence lines.

Existing screening will be maintained. The screening at the eastern end of the site will be reviewed and enhancements may be necessary.

Bramble patches around the edge are to be retained for hedgehogs. Management of edge habitat and promoting scrub growth along fence lines.

Grass is to be kept between 10 and 20cm and is to be carried out at least once a month between March and October following a high cut/low cut regime.

7.4 Intermediate and Final Acceptance Tests

The Intermediate Tests shall be carried out twelve (12) months after the completion of the Provisional Acceptance Tests.

The Final Acceptance Tests shall be carried out twelve (12) months after the completion of the Intermediate Tests.

Tests will follow the same protocol as per provisional acceptance testing (Section 6.3).

Inputs for the calculation of theoretical production shall be as follows:

- In-plane irradiance shall be measured in the same plane as the photovoltaic array by the pyranometer.
- In plane irradiation ('I') is measured using the pyranometer at the plant positioned at the same azimuth and tilt angle of the array and at a point which is judged to be representative of the overall plant location.

Measurements performed with the pyranometer will be recorded every fifteen (15) minutes. Every hour a median irradiation value will be calculated as follows: I_i (W/m²) at the I th hour. At the end of each period the total irradiation will be calculated as $I = \sum I_i$ where i is a value from 1 to 8,760 (eight thousand seven hundred and sixty) (hours) (equivalent to twelve (12) continuous months).

'I' shall be adjusted to exclude periods during which the actual production of the PV System has been affected for events outside Contractor's control such as theft, vandalism, power outage of the electrical grid or other grid instability events, Force Majeure Events, Authority's act or omission in breach of its obligations under this Agreement or negligence.

7.5 Plant Performance Monitoring

The Contractor will install suitable instruments and make adequate arrangements to monitor the on-going performance of the solar system. Connection of the monitoring system to the monitoring host website server will be via SCADA, GPS, SMS, TCP/IP or equivalent. The Contractor will advise the annual cost of the data contact to the Council and include this within its pricing. The Contractor will provide a system for automatic and remote monitoring of the following performance parameters as a minimum:

- DC array voltage (VA)
- DC array current (IA)
- DC array power (PA)
- AC output voltage (Vout)
- AC output current (Iout)
- AC output power (Pout)
- Output energy (Eout)

All plant generation and export metering systems will use MID approved meters and such meters will be positioned (together with suitable voltage and current transformers) to allow power to be metered upon export from the solar system.

The Contractor will be responsible for ensuring that the Guaranteed Availability of 99% is met and maintained.

The period for which the availability is calculated is yearly, starting from the signing of the Provisional Acceptance Certificate.

The PV System Availability shall be expressed as a percentage and calculated using the following formula:

$$\text{PV System Availability} = (\text{Astr1} + \text{Astr2} + \dots + \text{Astrn}) / \text{Nstr}$$

where

Astr1 (%) is the availability of String 1

Astr2 (%) is the availability of String 2

Astrn (%) is the availability of string 'n'

Nstr is the number of strings

The string availability shall be calculated using the following formula:

$$A_{Str1} = (T - OS1) / (T - CS1)$$

where

Astr1 (%) is the availability of string 1

T (hrs) = Operation hours when there is sufficient daylight (when inverter starts or irradiation > 60W/m²)

Os1 (hrs) = total hours of outage on string 1

Cs1 = hours when the string 1 is unavailable due to reasons outside of the control of the Contractor including the following:

- period of mechanic interruption due to a failure in the distribution network, disturbances or reductions of capacity related with the distribution network, so that PV System cannot direct energy to the network according to their technical specifications;
- events of Force Majeure;
- if there is a fluctuation of parameters in the network (a difference of frequency or overvoltage) so that the protection of the PV System is opened;
- inspections carried out by the technical supervision authorities or other inspections carried out at the request of the Council;
- periods of interruption caused by the Council;
- periods of unavailability due to an MV transformer replacement.

The PV systems will have a guaranteed availability of 99% over the year and the overall length of the contract;

If the contract covers less or more than a full year, the remaining days/weeks/months shall be looked separately, and the damages weighted over the time of reference. For example, if the contractor is the O&M for 2.5 years, year 1 and year 2 shall be calculated normally while the last half-year period shall be treated separately, and the damages shall be halved.

If irradiation data is not available for any period longer than one day over the calculated period, the Contractor shall be responsible to find an alternative solution such as satellite irradiation. If the data gaps are not continuous or are deemed negligible, the owner might agree to exclude the period from the calculations.

To avoid confusion, downtime within response time limits shall still be taken into account when calculating availability.

8. Handover Documentation

Within five (5) business days of Solar System commissioning, provisional acceptance testing the Contractor will provide one electronic and two bound hard copies of Handover Documentation containing the following items:

- Plant start-up and shut down procedures.
- As built drawings.
- Manufacturer's operating manuals including but not limited to modules, inverters, mounting systems, monitoring system, LV switchgear, cabling systems, CCTV, earthing systems and enclosures.
- Manufacturer's data sheets.
- Grid connection certification.
- Electrical test certificates.
- PV system verification certificate (IEC 62446: Annex A).
- Visual inspection test certificate (IEC 62446: Annex B).
- PV array test report (IEC 62446: Annex C).
- Building control approval certification if required.
- Equipment warranty certificates including but not limited to modules, inverters, mounting systems, monitoring system, LV switchgear, cabling systems, CCTV, earthing systems, and enclosures.
- Software access codes and login details.
- All other items required under CDM regulations.

- Relevant contact details.

Handover documents will be prepared and provided in accordance with IEC 62446-1-2016.

In addition to the above documentation, the Contractor will set aside a minimum of one day to handover the system to the Council or their nominated representative.

9. Parking, Materials Supply & Storage

The Contractor will ensure details for the parking, turning, loading and unloading of vehicles during construction, commissioning and for routine maintenance and inspection visits are submitted to the Council.

The Contractor will be free to store all construction materials on the site in secure storage throughout the duration of the Construction Contract. The proposed location of the construction compound and storage is to be agreed in advance and is to be shown on the Contractor's proposed site plan. The Contractor will advise the Council at least two weeks in advance of any significant materials deliveries.

The Contractor will ensure that the transportation and storage procedures of all elements of the solar system are carried out in accordance with manufacturer's recommendations. Particular attention will be given to maintaining controlled environmental conditions to prevent corrosion and degradation, and incorrect lifting or handling practices that may result in damage to components.

The Contractor will make sure that all statutory and appropriate measures are taken to prevent site contamination from diesel, petrol, oil, lubricants or other hazardous materials that may be stored on site or contained within equipment. They will also ensure that the proposed method for storage of plant, materials, fuel and chemicals is included within the Site Environmental Management Plan. The Contractor will make sure that the Site Environmental Management Plan is submitted and approved by the Council before site work commences.

The Contractor will guarantee that all freight and plant equipment operated on site does not exceed the load bearing capacity of the ground and due safeguards are implemented when ground conditions are hazardous.

All risk associated with materials, plant, equipment, tools and test equipment on site will rest with the Contractor and their insurers.

It will be the Contractor's responsibility to provide 24-hour security during the construction period. The Contractor should ensure that the level of security is appropriate to the area and takes into account the long standing anti-social behaviour/vandalism and fly tipping issues at both sites.

The Contractor's security shall remain active until the full security system is installed, the construction is complete, and the site has been handed over. The security should start at the commencement of pre-construction works/delivery of goods to site (whichever is sooner).

10. Access & Working Arrangements

The Contractor will produce Site Management and Traffic Plans which will be approved by the Council.

The Contractor will not display advertising boards or signs that promote their own organisation or that of sub-contractors or any other organisation.

The Contractor will not remove or move any displays, boards or signs that the Council has put in place within the site boundary without prior agreement with the Council.

The Contractor will be responsible for taking adequate measures to protect the site, including planting, buried services, roads and tracks, buildings, fixtures and fittings whilst works are in progress. They will be responsible for making good any damage resulting from their actions or omissions or caused by their sub-contractors, agents or consultants.

The Contractor will consider the potential impacts on neighbouring businesses and properties in designing, constructing and operating the solar system and will work in a considerate manner with the local community at all times. They will ensure that noise levels are kept to a minimum whilst undertaking the works, and will adhere to any working time restrictions that may be detailed in the contract Terms and Conditions/planning decision notice.

The Contractor will not disconnect or disrupt services such as gas, water, power, sewage and telecommunications without prior consent from the Council. In the case that such services need to be interrupted then they will be reinstated at the earliest possible opportunity and with approval from the Council.

The Contractor will work in a cooperative and considerate manner with other 3rd party contractors and organisations that may be undertaking work on site.

11. Personnel

11.1 Training & Qualifications

All staff employed by the Contractor will be suitably qualified and trained to undertake the duties they are allocated. The Contractor will ensure that all personnel receive necessary training to undertake their work safely and professionally. General requirements of operatives will include knowledge of the following:

- Site safety practices, rules and procedures.
- Working procedures employed by the Contractor.
- Specific plant and equipment in relation to safe, proper and efficient use.
- Safe systems of work, including Permit to Work Systems, Risk Assessments and Method Statements.
- Certified training in specific trade disciplines; typically apprenticeships, City & Guilds or equivalent.

All personnel entering or working on the site will receive a site induction, which will cover the following areas:

- Site H&S arrangements. Accident reporting.
- Traffic movements and traffic risks. First aid arrangements.
- Fire safety and evacuation arrangements. Specific site risks.
- Location of welfare facilities.
- Permit to Work arrangements.

All personnel will provide evidence of training if requested.

The Contractor, and their sub-contractors, consultants and advisors will hold relevant industry certifications for their trade or profession, including but not limited to:

Professional Engineers, Designers and Project Consultants: Undergraduate Degree from an appropriate national institution for the discipline concerned.

CDM Managers: Certification as a trained CDM Manager

Site Supervisors: NVQ Level 4 Certification in construction site supervision or Site Supervisors Safety Training Scheme.

Electrical Installation Contractors: Approval by the National Inspection Council for Electrical Installation Contracting (NICEIC) approval or equivalent.

Plant Operators: Training and certification in accordance with Construction Plant Competence Scheme standards or equivalent.

11.2 Uniforms & Passes

Site personnel will wear necessary Personal Protective Equipment (PPE) and work wear appropriate for the tasks being undertaken. They will carry identity passes.

12. Health & Safety

The Contractor will comply with relevant Health, Safety and Welfare legislation and specific site working rules. In particular, the Contractor will comply with the Council's guidance regarding site specific risks and Health and Safety Processes.

The Contractor shall ensure that all design work and processes comply with the Construction (Design and Management) Regulations (CDM) 2015. If the scale of the project is significant enough to make the project notifiable to the HSE then the Council will appoint the Contractor Principal Contractor and post contract Principal Designer. The Contractor will liaise with the Council's pre contract Principal Designer/CDM Advisor on all H&S and CDM requirements.

Personnel working on site will undertake a site induction and will be made aware of site-specific risks or procedures as part of that induction.

The Contractor will cooperate with the Council on all issues concerning Health and Safety and will attend all necessary site induction and health and safety meetings. When the Contractor identifies potential hazards they will report it immediately to the Council and will take immediate steps to mitigate the risks.

The Council reserves the right to conduct unannounced Health and Safety site audits and inspections of the Contractor's site operations.

The Contractor will comply with all instructions issued by the Council concerning Health and Safety.

The Contractor will comply with and work under their Permit to Work Systems when undertaking the following work tasks:

Working at height if applicable.

Confined spaces.

Electrical distribution systems.

Hot working.

Working at height will **only** be undertaken with the correct use of suitable and compliant scaffolding, edge protection, access towers and fall arrest systems. Workers undertaking working at height should be suitably trained and certified in the use of all such access equipment. Scaffolding and access systems are to be installed following NASC TG20:13 Guide to Good Practice for Tube Fitting Scaffolding, inspected by qualified personnel and approved prior to first use and at regular inspection intervals through a Scafftag or similar system.

The Contractor will produce risk assessments and method statements (RAMS) for approval by the Council a minimum of 2 weeks before commencing the works. The Contractor is advised that both sites are on contaminated land (please refer to the contaminated land studies in appendix 1 and 2) that have a history of anti-social behaviour and drug use. This must be reflected in the RAMS.

The Contractor will implement fire safety measures at the site and make sure that all staff are aware of fire safety emergency actions and associated assembly points.

The Contractor will produce site waste management plans as part of the Environmental Management Plans (section 14) for both sites. Particular attention must be paid to the contaminated land surveys in respect of soil arising that may occur, the method of disposal as well as the risk to construction workers.

Waste and recycling skips/containers must be lockable and no waste is to left outside of these at any time. Waste should be removed from site once a week as a minimum.

The Contractor must provide details of its proposed waste carrier and the required licences.

13. Housekeeping

The Contractor will maintain the working area in a tidy and orderly fashion and will remove all waste and debris to suitable storage areas for sorting and recycling at the end of each working day. The Contractor is responsible for the regular removal of waste and materials for recycling from site via a registered waste carrier.

The Contractor will make good any damage caused by it or its subcontractors.

14. Environmental Management

14.1 General Requirements

The Contractor will appoint a competent person to the role of Environmental Manager for the project who will develop and maintain a comprehensive Construction Environmental Management Plan for the project. The Environmental Manager will be responsible for:

- Visiting and surveying the site upon contract commencement
- Meeting the site's representative on contract commencement.
- Incorporating site requirements into the Environmental Management Plan.
- Attending meetings where construction activities may give rise to potential environmental issues.

The Environmental Manager will submit the Construction Environmental Management Plan for approval by the Council prior to construction work commencing. The Construction Environmental Management Plan will address the following minimum requirements: Air quality, dust and noise. Ecology considerations. Waste materials and waste management.

The Environmental Manager will be responsible for ensuring that appropriate specialists are present on site as and when required.

The Contractor will appoint a competent person to act as the Environmental Site Representative. This person will be responsible for ensuring that the measures highlighted in the Contractor's Environmental Management Plan are adhered to and will be the first point of contact for any environmental incidents.

14.2 Biodiversity Protection during Construction

The Contractor will adhere to any biodiversity and biosecurity related planning conditions for the construction of the solar farms and in line with the planning conditions as listed in Appendix 3.

The Contractor must review these recommendations and implement them as necessary. Following the appointment of the Contractor, a pre-start site meeting will be held with the Council's Ecologist and Countryside Services, to identify existing habitats that can be retained during the construction.

14.3 Biodiversity Improvements Post Construction

The Contractor shall suggest biodiversity enhancements that could be implemented post construction

15. Sub-Contractors

The Contractor will seek the Council's approval prior to appointing sub-contractors that will work on the construction site and they will ensure that sub-contractors will comply with the requirements of the Contract at all times.

There are a number of specific contract terms regarding sub-contractors including collateral warranties which should be reviewed in line with this specification. The Council will seek collateral warranties for all major component supply and installation sub-contractors.

16. Utilities

There is no electricity or water supply at the site, therefore the Contractor must make adequate arrangements for utilities and welfare units etc.

17. Relevant Standards

Equipment and/or services provided under the contract will comply with the relevant BS EN, IEC, ISO or other suitable standards. This includes, but is not limited to the standards below:

17.1 PV Systems

IET Code of Practice for Grid Connected Solar Photovoltaic Systems

ER G99 Issue 1 (or equivalent) Requirements for the connection of generation equipment in parallel with public distribution networks;

ER G59 (or equivalent) Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators;

BRE National Solar Centre: Biodiversity Guidance for Solar Developments (2014). <https://www.bre.co.uk/filelibrary/pdf/Brochures/NSC-Biodiversity-Guidance.pdf>

17.2 Modules

PV Modules: IEC 61730-Safety qualification testing, IEC 61701-Operation in corrosive atmosphere.

IEC 61683: 1999 Photovoltaic systems – Power conditioners – Procedure for measuring efficiency. Table 2: PV Module Standards

IEC 61646 Thin-film terrestrial photovoltaic (PV) modules – Design qualification and type approval.

EN/IEC 61730 PV module safety qualification.

IEC 61701 Resistance to salt mist and corrosion.

IEC 61000 Electromagnetic compatibility

IEC 61215: Crystalline Silicon PV Modules qualification

17.3 Inverters

IEC 62103, 62109 and 62040 (UL 1741): Safety of Static Inverters – Mechanical and Electrical Safety aspects.

IEC 62116: Testing procedure of Islanding Prevention Methods for Utility – Interactive PV Inverters.

17.4 Cabling

BS 60228: Specification for conductors of insulated cables

Guide to the short-circuit temperature limits of electric cables with a rated voltage not exceeding 0.1/1.0kV.

17.5 Frameworks

BS 1377-3: Methods of test for soils for civil engineering purposes. Chemical and electro-chemical tests.

17.6 Grid connection

Engineering Recommendation G99 Issue 1 – Requirements for the connection of generation equipment in parallel with public distribution networks on or after 17 May 2019.

BS 7354: Design of High Open Terminal Substations.

ENA Engineering recommendations G5/4.

ENA Engineering recommendation P2/6 Security of supply.

17.7 Installation

BS7671-2018 requirements for electrical installations.

17.8 Safety

Electricity Safety, Quality and Continuity regulations (ESQCR):2002

Effects of current on human beings and livestock. Part 1: General aspects. 42

EN 61000-6-4: 2007 Electromagnetic compatibility (EMC). Generic standards. Emission standard for industrial environments.

EN 55022: 2006 Information technology equipment. Radio disturbance characteristics. Limits and methods of measurement.

IEC TS 6100 Electromagnetic Immunity for power station and substation Environments.

Health and Safety at Work Act (HASWA): 1974.

Electricity at Work Regulations (EaWR) 1989

17.9 Balance of system equipment

BS EN 60255 series measuring relays and protection equipment.

BS EN 61810 series Electromechanical Elementary relays.

BS EN 60947 series Low Voltage Switchgear and Control gear.

BS 28998: Specification for wrought aluminium and aluminium alloys for electrical purposes. Bars, extruded round tube and sections.

BS EN60298 EN 60298: A.C. metal-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV.

EN 50178: 1997 Electronic equipment for use in power installations.

BS EN 60044 Instrument transformers, Current transformers.

17.10 Earthing

BS 7430: Code of Practice for Earthing

ENA TS 41-24: Guidelines for the Design, Installation, Testing and Maintenance of Main Earthing Systems in Substations.

ENA TS 43-94: Earth Rods and Connectors.

ENA ER S34: A Guide for Assessing the Rise of Earth Potential at Substation Sites.

ENA ER S36: Identification and Recording of 'Hot Sites' –Joint Electricity Industry/British Telecom Procedure.

17.11 Documentation and commissioning

BS EN 62446-1 Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance part 1 – Grid connected systems – Documentation, commissioning tests and inspection.

BS EN 62446-2 Photovoltaic (PV) systems – Requirements for testing, documentation and maintenance part 2: Grid connected systems – Maintenance of PV systems

17.12 Construction

BS 1377-3: Methods of test for soils for civil engineering purposes. Chemical and electro-chemical tests.

BS EN13043: Aggregates for use in bituminous mixtures and surface treatments for roads, airfields and other trafficked areas.

18. Community Benefits

Cheshire East Council is committed to maximising the social value from the goods and services it purchases. The Council has recently adopted a Social Value Strategy to increase the generation of social value and deliver lasting benefits to the local community. The Social Value Strategy reflects the priorities of the Council Plan:

Ambitious Council: Business sector growth and regeneration

Learning Council: High performing education

Green Council: Sustainable development and environmental management, safe and sustainable travel services

Connected Council: Resilient Communities

Serving Council: Effective Resource Management

Supportive Council: Appropriate and affordable homes; modern, efficient and adapted homes; protecting people from poverty; independent living, integrated community social and health services; safeguarding.