REQUEST FOR QUOTATION (RFQ)
(Goods & Services)

UNDP IRH RBEC	DATE: 13 May 2020
	REFERENCE: UNDPIRH-202005-RFQ-09-Provision of Solar System

Dear Sir / Madam:

We kindly request you to submit your quotation for **Provision of Installation of Solar System** , as detailed in Annex 1 to 12 of this RFQ. When preparing your quotation, please be guided by the form attached hereto as Annex 13.

Quotations may be submitted on or before **May 27, 2020** and via (choose appropriate box) ☒*e-mail* to the address below:

United Nations Development Programme
procurement.irh@undp.org

Quotations submitted by email must be limited to a maximum of **35** MB, virus-free and no more than **5** email transmissions. They must be free from any form of virus or corrupted contents, or the quotations shall be rejected.

It shall remain your responsibility to ensure that your quotation will reach the address above on or before the deadline. Quotations that are received by UNDP after the deadline indicated above, for whatever reason, shall not be considered for evaluation. If you are submitting your quotation by email, kindly ensure that they are signed and in the .pdf format, and free from any virus or corrupted files.

Please take note of the following requirements and conditions pertaining to the supply of the abovementioned goods & services:

Exact Address/es of Delivery Location/s (identify all, if multiple)	Krtsanisi Forest Park, Kvemo Kartli Region, Georgia. Cadastral Code: 81.05.13.545 1 km of Tbilisi-Rustavi highway, Gardabani Municipality, near Ponichala village
Type of competition	National Competition[1]
Latest Expected Delivery Date and Time *(if delivery time exceeds this, quote may be rejected by UNDP)*	15 October, 2020
Delivery Schedule	☒Required
Preferred Currency of Quotation[2]	☒ United States Dollars (USD)
Value Added Tax on Price Quotation[3]	☒ Must be exclusive of VAT and other applicable indirect taxes
After-sales services required	☒Warranty on the PV Module proposed product for minimum 12 years ☒Warranty on the PV Module proposed linear output for minimum 25 years ☒Warranty on the proposed Inverter product for minimum 10 years ☒Technical Support Whenever needed
Deadline for the Submission of Quotation	COB, ***Wednesday, May 27, 2020 by 17:00*** *Istanbul Time (UTC +3)*
All documentations, including catalogs, instructions and operating manuals, shall be in this language	☒ English

[1] *Works are Locally available. However, international suppliers are encouraged and not limited to apply where requirements of the tender conditions are met.*

[2] *Local vendors must comply with any applicable laws regarding doing business in other currencies. Conversion of currency into the UNDP preferred currency, if the offer is quoted differently from what is required, shall be based only on UN Operational Exchange Rate prevailing at the time of UNDP's issuance of Purchase Order. https://treasury.un.org/operationalrates/OperationalRates.php*

[3] *This must be reconciled with the INCO Terms required by the RFQ. Furthermore, VAT exemption status varies from one country to another. Pls. tick whatever is applicable to the UNDP CO/BU requiring the good*

Documents to be submitted[6]	☒ Duly Accomplished Form as provided in Annex 2, and in accordance with the list of requirements in Annexes 1; ☒ Licenses of installation of solar systems and/or power supply systems; ☒ Registration of the company in Georgia since 2016 to provide services with the same nature as the one in this TOR (installing Solar system or power supply systems); ☒ Applicants must have work license in Georgia to be eligible for this tender; ☒ Quality Certificates (ISO, etc.); ☒ Latest Business Registration Certificate; ☒ Latest Internal Revenue Certificate / Tax Clearance; ☒ Manufacturer's Authorization of the Company as a Sales Agent (if Supplier is not the manufacturer); ☒ Certificate of Exclusive Distributorship in the country (if applicable, and if Supplier is not the manufacturer); ☒ Evidence/Certification of Environmental Sustainability ("Green" Standards) of the Company or the Product being supplied; ☒ Written Self-Declaration of not being included in the UN Security Council 1267/1989 list, UN Procurement Division List or other UN Ineligibility List (Annex 4); ☒ Minimum 3 years of relevant experience. ☒ Minimum 3 contracts of similar value, nature and complexity implemented over the last 3 years
Period of Validity of Quotes starting the Submission Date	☒ 90 days In exceptional circumstances, UNDP may request the Vendor to extend the validity of the Quotation beyond what has been initially indicated in this RFQ. The Proposal shall then confirm the extension in writing, without any modification whatsoever on the Quotation.
Partial Quotes	☒ Not permitted

Payment Terms[4]	In 4 installments upon the delivery and approval of the schedule in Terms of Reference
Liquidated Damages	Percentage of contract price per day of delay: 0.5% Max. number of days of delay 20, after which UNDP may terminate the contract.
Evaluation Criteria *[check as many as applicable]*	☒ Technical responsiveness/Full compliance to requirements and lowest price8 ☒Comprehensiveness of after-sales services Response time for any repair calls must be less than 72 hours The availability of stock of spare parts for the proposed system components ☒ Full acceptance of the PO/Contract General Terms and Conditions ☒ The Company relevant experience with similar complexity in the last 3 years ☒ Delivery Time / Work Schedule
UNDP will award to[5]:	☒ One and only one supplier
Type of Contract to be Signed	☒ Contract for - Goods and/or Services
Special conditions of Contract	☒ Cancellation of PO/Contract if the delivery/completion is delayed by 20 days
Conditions for Release of Payment	☒ Approval of Detail Work Plan and approval of works done on site to install the Solar System Station ☒ Deliver and full installation of the Solar System PV station ☒ Deliver and Full installation of the power Grid in the site to connect the PV station to the Transformer and to the Pump station site ☒ Testing the whole system performance. Training, and handover the system to the UNDP-GEF Kura II project and Georgian Wildlife Agency requirements

[4] *UNDP preference is not to pay advanced amount upon signing of contract. If vendor strictly requires advanced payment, it will be limited only up to 20% of the total price quoted. For any higher percentage, or advanced payment of $30,000 or higher, UNDP shall require the vendor to submit a bank guarantee or bank cheque payable to UNDP, in the same amount as the advanced payment made by UNDP to the vendor.*

[5] *UNDP reserves the right not to award the contract to the lowest priced offer, if the second lowest price among the responsive offer is found to be significantly more superior, and the price is higher than the lowest priced compliant offer by not more than 10%, and the budget can sufficiently cover the price difference. The term "more superior" as used in this provision shall refer to offers that have exceeded the pre-determined requirements established in the specifications.*

Annexes to this RFQ[6]	☒ Technical Specifications (TOR)(Annex 1) ☒ General terms of reference for the photovoltaic power system (Annex 1.1) ☒ Simulation renders for the layout of solar panels in the area (Annex 1.2) ☒ Technical requirements for solar panels (Annex 1.3) ☒ Technical requirements for network on grid invertor (Annex 1.4) ☒ Drawings of solar panel stand (Annex 1.5) ☒ Requirements for solar panel stand (Annex 1.6) ☒ Requirements for solar cable (Annex 1.7) ☒ Technical requirements for MC4 coupling (Annex 1.8) ☒ Requirements for AC network cable (Annex 1.9) ☒ Layout of the Network grid to be arranged in the area and cable parameters (Annex 1.10) ☒ electrical circuit of the water pump equipment cabinet (Annex 1.11) ☒ Price Quotation (Annex 2) ☒ General Terms and Conditions / Special Conditions (Annex 3). ☒ Written Declaration (Annex 4) Non-acceptance of the terms of the General Terms and Conditions (GTC) shall be grounds for disqualification from this procurement process.
Contact Person for Inquiries (Written inquiries only)[7]	*procurement.irh@undp.org* *All questions must be received 5 days before the submission deadline* Any delay in UNDP's response shall be not used as a reason for extending the deadline for submission, unless UNDP determines that such an extension is necessary and communicates a new deadline to the Proposers.

Goods offered shall be reviewed based on completeness and compliance of the quotation with the minimum specifications described above and any other annexes providing details of UNDP requirements.

The quotation that complies with all of the specifications, requirements and offers the lowest price, as well as all other evaluation criteria indicated, shall be selected. Any offer that does not meet the requirements shall be rejected.

[6] *Where the information is available in the web, a URL for the information may simply be provided.*

[7] *This contact person and address is officially designated by UNDP. If inquiries are sent to other person/s or address/es, even if they are UNDP staff, UNDP shall have no obligation to respond nor can UNDP confirm that the query was received.*

Any discrepancy between the unit price and the total price (obtained by multiplying the unit price and quantity) shall be re-computed by UNDP. The unit price shall prevail and the total price shall be corrected. If the supplier does not accept the final price based on UNDP's re-computation and correction of errors, its quotation will be rejected.

After UNDP has identified the lowest price offer, UNDP reserves the right to award the contract based only on the prices of the goods in the event that the transportation cost (freight and insurance) is found to be higher than UNDP's own estimated cost if sourced from its own freight forwarder and insurance provider.

At any time during the validity of the quotation, no price variation due to escalation, inflation, fluctuation in exchange rates, or any other market factors shall be accepted by UNDP after it has received the quotation. At the time of award of Contract or Purchase Order, UNDP reserves the right to vary (increase or decrease) the quantity of services and/or goods, by up to a maximum twenty five per cent (25%) of the total offer, without any change in the unit price or other terms and conditions.

Any Purchase Order that will be issued as a result of this RFQ shall be subject to the General Terms and Conditions attached hereto. The mere act of submission of a quotation implies that the vendor accepts without question the General Terms and Conditions of UNDP herein attached as Annex 3.

UNDP is not bound to accept any quotation, nor award a contract/Purchase Order, nor be responsible for any costs associated with a Supplier's preparation and submission of a quotation, regardless of the outcome or the manner of conducting the selection process.

Please be advised that UNDP's vendor protest procedure is intended to afford an opportunity to appeal for persons or firms not awarded a purchase order or contract in a competitive procurement process. **In the event that** you believe you have not been fairly treated, you can find detailed information about vendor protest procedures in the following link:
http://www.undp.org/content/undp/en/home/operations/procurement/protestandsanctions/

UNDP encourages every prospective Vendor to avoid and prevent conflicts of interest, by disclosing to UNDP if you, or any of your affiliates or personnel, were involved in the preparation of the requirements, design, specifications, cost estimates, and other information used in this RFQ.

UNDP implements a zero tolerance on fraud and other proscribed practices, and is committed to identifying and addressing all such acts and practices against UNDP, as well as third parties involved in UNDP activities. UNDP expects its suppliers to adhere to the UN Supplier Code of Conduct found in this link : http://www.un.org/depts/ptd/pdf/conduct_english.pdf

Thank you and we look forward to receiving your quotation.

Sincerely yours,

Procurement IRH
13 / May/ 2020

Annex 1

Technical Specification

General Information

1.Title

Installation of the 100 kW grid-connected photovoltaic power system to be located in the Krtsanisi Municipal Forest (cadastral code 81.05.13.545). Along with the installation of the solar power plant, a power grid shall be installed in the area connecting the solar power plant to the transformer located in the area. The grid-connected photovoltaic power system must supply electricity to the water pump station, which will pump water from the Kura River into the lakes in the municipal forest. The project is being implemented in cooperation with the LEPL National Wildlife Agency under the Ministry of Environment Protection and agriculture of Georgia. The contractor will also conduct a 3-day training program on the field for the appropriate representatives of the LEPL National Wildlife Agency under the Ministry of Environment Protection and agriculture of Georgia on operation and maintenance of the constructed 100 kW Solar System Station. The contractor will provide a user manual for the operation and preventive maintenance of the proposed system and use this manual for the training of the LEPL staff.

2.Project Title

UNDP-GEF Kura II Project "Advancing Integrated Water Resource Management (IWRM) across the Kura river basin through implementation of the transboundary agreed actions and national plans"

3. Project Description

The UNDP-GEF Kura II Project will be implementing the **Strategic Action Program** (SAP) for the Kura River Basin in partnership with the Governments of Georgia and Azerbaijan. The SAP is framed around four agreed Ecosystem Quality Objectives (EQO) which are:

- To achieve sustainable utilization of water resources to ensure access to water and preserve ecosystem services;
- To achieve water quality such that it would ensure access to clean water for present and future generations and sustain ecosystem functions in the Kura river basin;
- To achieve and maintain ecosystem status whereby they provide essential environmental and socio-economic services in a sustainable manner in the Kura River Basin; and,
- To achieve mitigation of adverse impacts of flooding and climate change on infrastructures, riparian ecosystems and communities.

The GEF will support priority activities towards these objectives. The GEF funded SAP implementation Project has the objective "to integrate water resources management in the Kura river basin to address water-energy-food-ecosystem security nexus through the implementation of agreed actions in the SAP". There will be five components to support the countries to achieve this objective. One of the main components of the Project is component 3 "Stress reduction in critical areas and pre-feasibility studies to identify investment opportunities for improving river system health". This component includes output 3.3 "River restoration projects for improved ecosystem health using integrated flow management". The

UNDP-GEF Kura II project received a request from the Ministry of Environment Protection and Agriculture of Georgia to support the national Wildlife Agency in the restoration of Krtsanisi floodplain Forest. This forest has been degraded due to the lowering of the Kura riverbed as a result of long term gravel abstractions and hydropower developments upstream of this forest. The project reviewed the master plan prepared by the national wildlife agency and hired an international expert in floodplain ecological restoration to review this master plan and make environmental assessment of this master plan. Also, the expert will provide a road map for long-term and shot term interventions to restore this floodplain forest and improve its ecological status.

One of the interventions stated in the floodplain restoration master plan is to install 100 kw grid-connected photovoltaic power system to be located in the Krtsanisi Municipal Forest (cadastral code 81.05.13.545). Along with the installation of the solar power plant, a power grid shall be installed in the area connecting the solar power plant to the transformer located in the area. The grid-connected photovoltaic power system must supply electricity to the water pump station, which will pump water from the Kura River into the lakes in the municipal forest. The project is being implemented in cooperation with the LEPL National Wildlife Agency under the Ministry of Environment Protection and agriculture of Georgia

4. Scope of Work

The Supplier shall ensure the supply of the grid-connected photovoltaic power system components, their installation and connection to the grid (inclusion in the net metering program for bilateral metering purpose) in the Krtsanisi Municipal Forest, also arrangement of internal power grid (380 V) in the area for connection of the station to the grid, active monitoring for 6 months after commissioning of the station through online monitoring. The online monitoring of the system should be available after 6 months during the total period of plant operation.

The supplier shall, if necessary, eliminate a defect in the system operation, if any. In addition to the warranty conditions of the major components (e.g. solar panel, invertor), the supplier is responsible for the proper operation of all components and the entire system.

The total installed capacity of the system shall be not less than 99.84 kW.

Where appropriate, the supplier shall consider that the grid-connected photovoltaic power system project shall be submitted to the Gardabani Municipality Architectural Service for approval, and the project shall, as appropriate, be adapted to the requirements of the Service.

The supplier will be responsible for the following activities:

- Submit detailed work plan for all activities to install the solar system station
- Get required approval of the proposed grid-connected photovoltaic power system form the Gardabani Municipality Architectural Service
- Preform all the works to prepare the site for installing the proposed solar system and the cable for the power grid to connect the solar power plant to the transformer located in the area. This work includes preparing the site to install the solar panel system as in the drawings in Annex 1.1. The contractor will fix the panel hangers to the ground as in the drawing in Annex 1.5. Also, the work includes excavation and backfilling of a small duct in the ground for the power cables network to connect the solar station system to the existing transformer in the site and from the transformer to the pump station intake site as shown in the drawings in Annex 1.10
- Purchase all the equipment and parts needed to install this station and the power grid to connect the station to the existing transformer on the site
- Transportation of the equipment and parts to the installation site does not require any prior permit As Beneficiary is state agency and the owner of the site.
- Full installation of the proposed solar system station on the selected site

- Full installation of the power grid to connect the solar power station to the transformer located in the area
- Testing the system performance to ensure it is working according to the specification stated in this TOR and ensure full connectivity between the solar power station and the transformer
- Handover the solar system station and the power grid to the representatives of the national wildlife agency of Georgia
- Conduct 3-day training course for 4 technicians from the national wildlife agency on the operation and maintenance of the installed solar system station
- Provide after-sales maintenance for the installed solar system station during the warrantee period.

Technical specifications of grid-connected photovoltaic power system

- The photovoltaic power system must be installed in compliance with all technical requirements, especially the conditions of grid connection, to ensure uninterrupted operation of the system.
- General terms of reference for the photovoltaic power system are given in Annex (1.1).
- Simulation renders for the layout of solar panels in the area are given in Annex (1.2)
- Technical requirements for solar panels are set forth in Annex (1.3).
- Technical requirements for network on grid invertor see in Annex (1.4).
- Drawings of solar panel stand see in Annex (1.5).
- Requirements for solar panel stand see in Annex (1.6).
- Requirements for solar cable see in Annex (1.7).
- The technical requirements for MC4 coupling are given in Annex (1.8)
- Requirements for AC network cable is given in Annex (1.9)

Grid technical requirements

- In order for the solar power station to be connected to the central grid, an internal grid needs to be installed in the area, which involves pulling the cable (underground) from the existing transformer to the solar power station (about 800 meters). Between the transformer and the solar power station the cable must be cut, the distribution point must be arranged to connect the water pump equipment.
  The drawing of the network grid to the arranged in the area and cable parameters are given in Annex (1.10) .
- The electrical circuit of the water pump equipment cabinet is given in Annex (1.11).
- The Bill of Quantities for the components of the required 100 kW Solar System Station are shown in Annex 2

5.Institutional Arrangements

The contractor will work under direct supervision of and will be directly reporting to the UNDP-GEF Kura II Project National Coordinator in Georgia. The contractor shall work in close cooperation with UNDP GEF Kura Project national expert for electrical engineering. The contractor shall submit reports on completion of the tasks to the UNDP-GEF Kura II project PCU. The contractor is expected to interact and collaborate with the LEPL National Wildlife Agency under the Ministry of Environment Protection and agriculture of Georgia during the entire period of contract.

6.Duration of the Work

135 calendar days after signing of the contract.

7.Workplace

Krtsanisi Forest Park, Kvemo Kartli Region, Georgia. Cadastral Code: 81.05.13.545
1 km of Tbilisi-Rustavi highway, Gardabani Municipality, near Ponichala village,

Additional information for RFQ

Timing

The installation of the 100 kW Solar System Station for the floodplain ecological restoration in Krtsanisi Forest Park, Georgia should be executed during the period June 2020 – October 2020. This work will include the installation of the power grid to connect the solar system station to the transformer located in the area.

Payments and Deliverables schedule

The payment schedule will be as follows:

Installments	Due Date	%
First Payment: Preparation of the site for installation	June 2020	10
Second Payment: Deliver and full installation of the components for the 99.84 KW ground mounted on grid PV solar system	20 August 2020	30
Third Payment Setting up of Grid Connection for Water Pumps and Solar PV Station	15 Sep. 2020	30
Fourth Payment: Testing and handover the systems to the UNDP/GEF Kura II project and conduct training for the representatives of the LEPL National Wildlife Agency	15 Oct. 2020	30

Payment schedule

The payment schedule stated in Table (1) in Annex (2) of this RFQ

Qualifications of Company:

Assessment of tender bids will be based on the following obligatory key criteria:

- Minimum 3-year experience in installing and maintenance solar panel systems;
- At least 3 years of experience working in purchasing and installing power supply systems is required,
- The availability of the after-sales maintenance services for the installed system
- The availability of stock of spare parts for the different components of the installed system
- Comments due to materials: The martials used in the system, the fittings, the screws, the panels, and cables must be ISO certificated products and have minimum 1-year warranty.

Annex 1.1

Your PV system

Address of Installation

Krtsanisi Forest Park, Kvemo Kartli Region, Georgia.
Cadastral Code: 81.05.13.545
1 km of Tbilisi-Rustavi highway, Gardabani Municipality, near Ponichala village

Project Overview

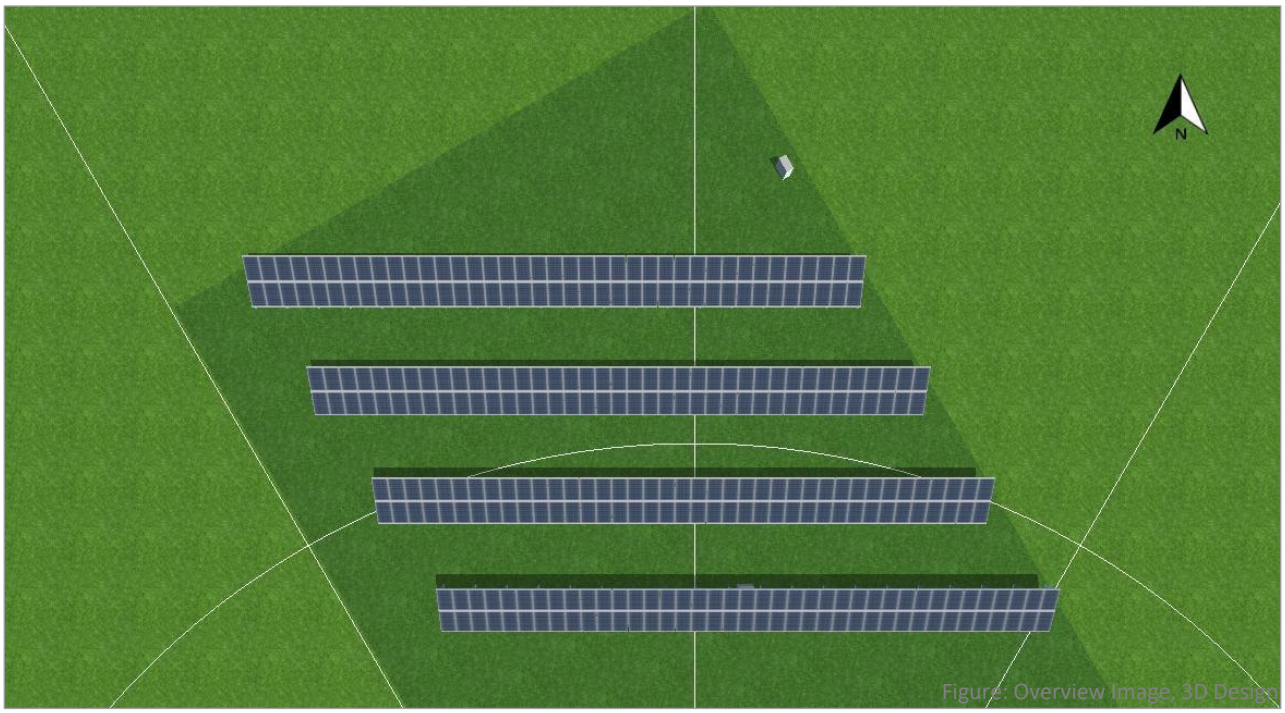


Figure: Overview Image, 3D Design

PV System

3D, Grid-connected PV System

Climate Data	Tbilisi,	GEO	(1991	-	2010)
PV Generator Output			99.84		kWp
PV Generator Surface			514.9		m²
Number of PV Modules			312		
Number of Inverters			3		

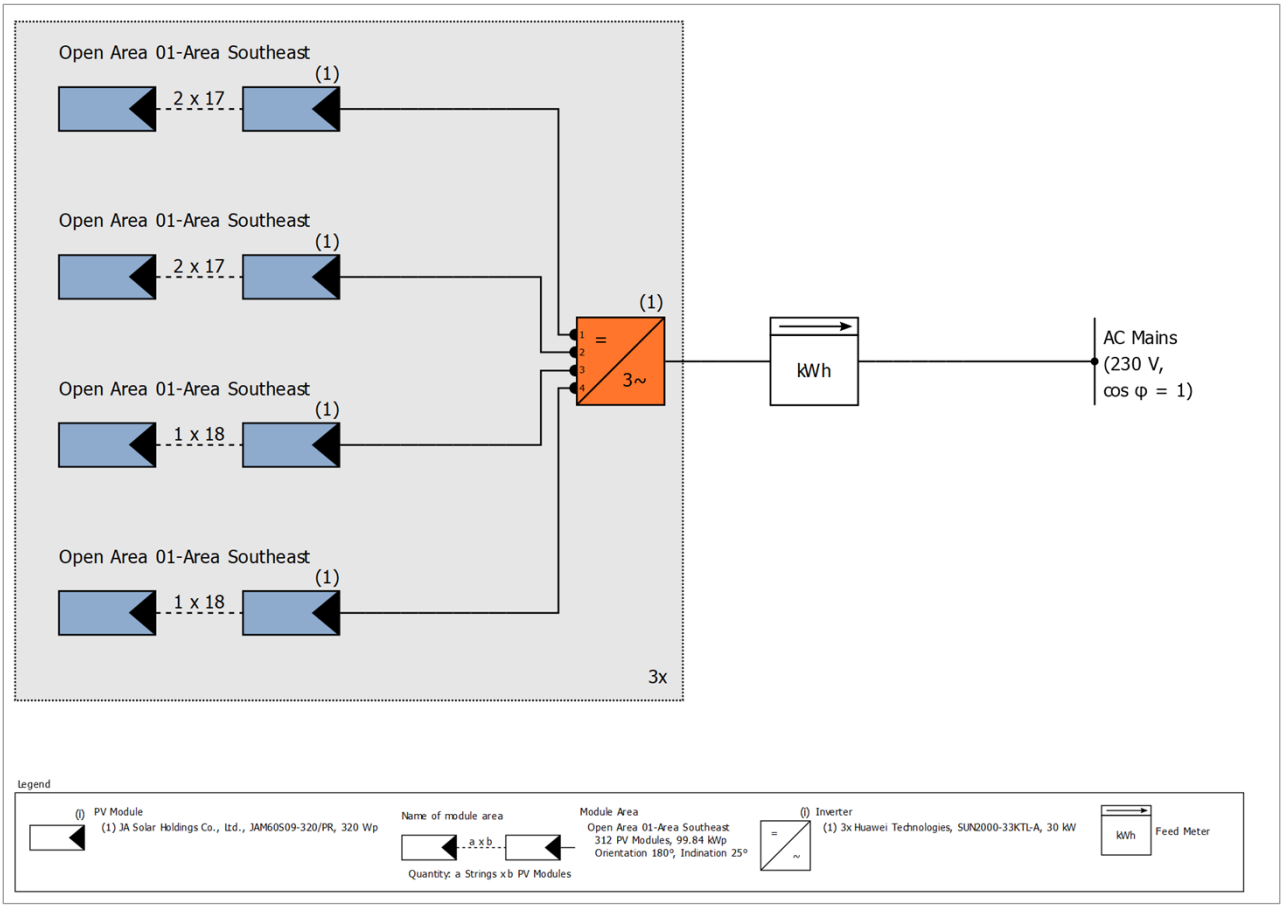


Figure: Schematic diagram

The yield

The yield	
PV Generator Energy (AC grid)	128,926 kWh
Grid Feed-in	128,926 kWh
Down-regulation at Feed-in Point	0 kWh
Own Power Consumption	0.0 %
Solar Fraction	0.0 %
Spec. Annual Yield	1,291.33 kWh/kWp
Performance Ratio (PR)	89.1 %
Yield Reduction due to Shading	2.8 %/year
CO_2 Emissions avoided	77,356 kg / year

The results have been calculated with a mathematical model calculation from Valentin Software GmbH (PV*SOL algorithms). The actual yields from the solar power system may differ as a result of weather variations, the efficiency of the modules and inverter, and other factors.

Set-up of the System

Overview

System Data

Type of System	3D, Grid-connected PV System
Start of Operation	2/8/2020

Climate Data

Location	Tbilisi, GEO (1991 - 2010)
Resolution of the data	1 h
Simulation model used:	
- Diffuse Irradiation onto Horizontal Plane	Hofmann
- Irradiance onto tilted surface	Hay & Davies

Module Areas

1. Module Area - Open Area 01-Area Southeast

PV Generator, 1. Module Area - Open Area 01-Area Southeast

Name	Open Area 01-Area Southeast
PV Modules	312 X 320 W
Manufacturer	
Inclination	25 °
Orientation	South 180 °
Installation Type	Mounted – Open Space
PV Generator Surface	514.9 m²

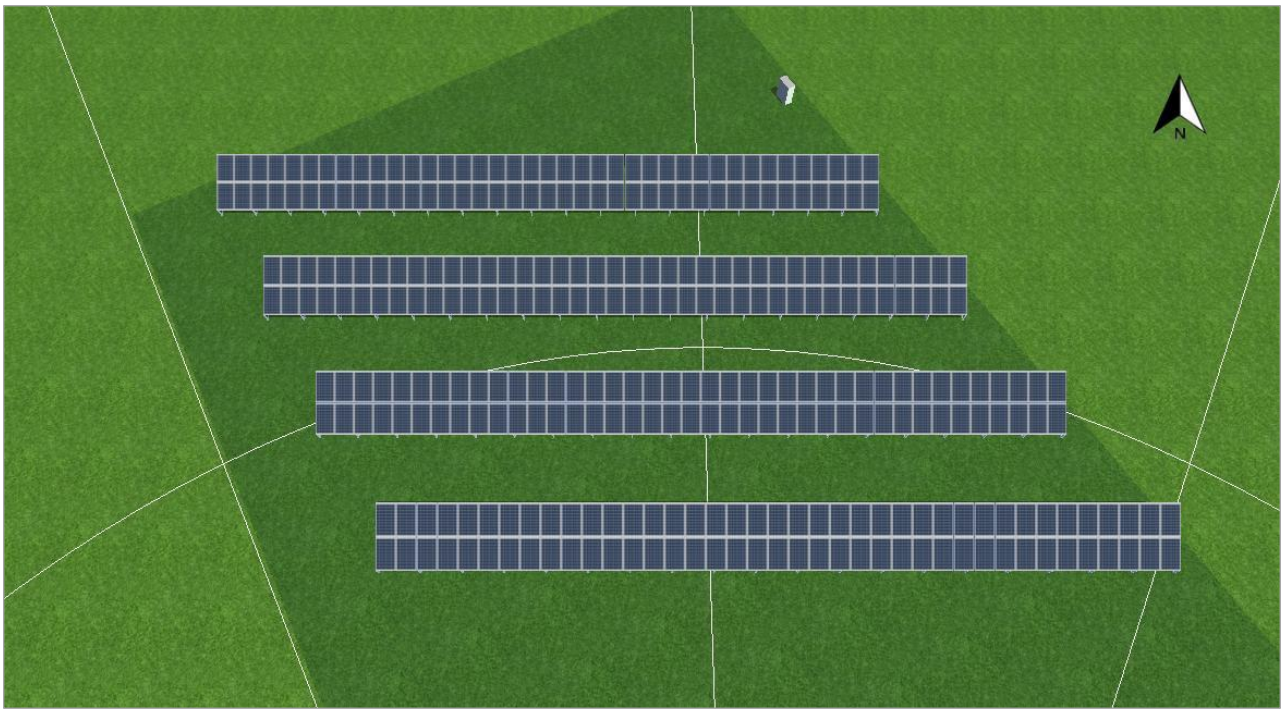


Figure: 1. Module Area - Open Area 01-Area Southeast

Horizon Line, 3D Design

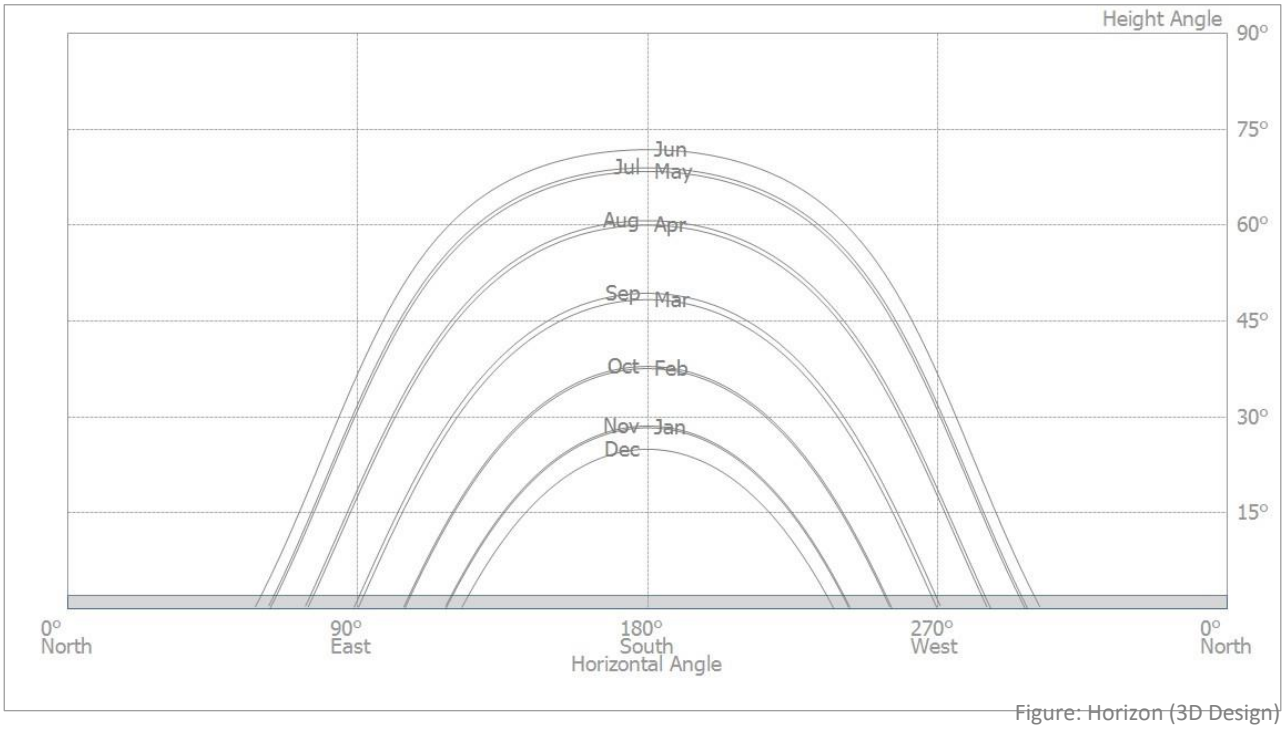


Figure: Horizon (3D Design)

Inverter configuration

Configuration 1

Module Area	Open Area 01- Area Southeast
Inverter I	
Manufacturer	
Model	33 KW
Quantity	3
Sizing Factor	110.9 %
Configuration	MPP 1: 2 X 17
	MPP 2: 2 X 17
	MPP 3: 2 X 18
	MPP 4: 2 X 18

AC Mains

AC Mains

Number of Phases	3
Mains Voltage (1-phase)	230 V
Displacement Power Factor (cos phi)	+/- 1

Simulation Results

Results Total System

PV System	
PV Generator Output	99.8 kWp
Spec. Annual Yield	1,291.33 kWh/kWp
Performance Ratio (PR)	89.1 %
Yield Reduction due to Shading	2.8 %/year
Grid Feed-in	128,926 kWh/year
Grid Feed-in in the first year (incl. module degradation)	128,926 kWh/year
Standby Consumption (Inverter)	38 kWh/year
CO_2 Emissions avoided	77,356 kg / year

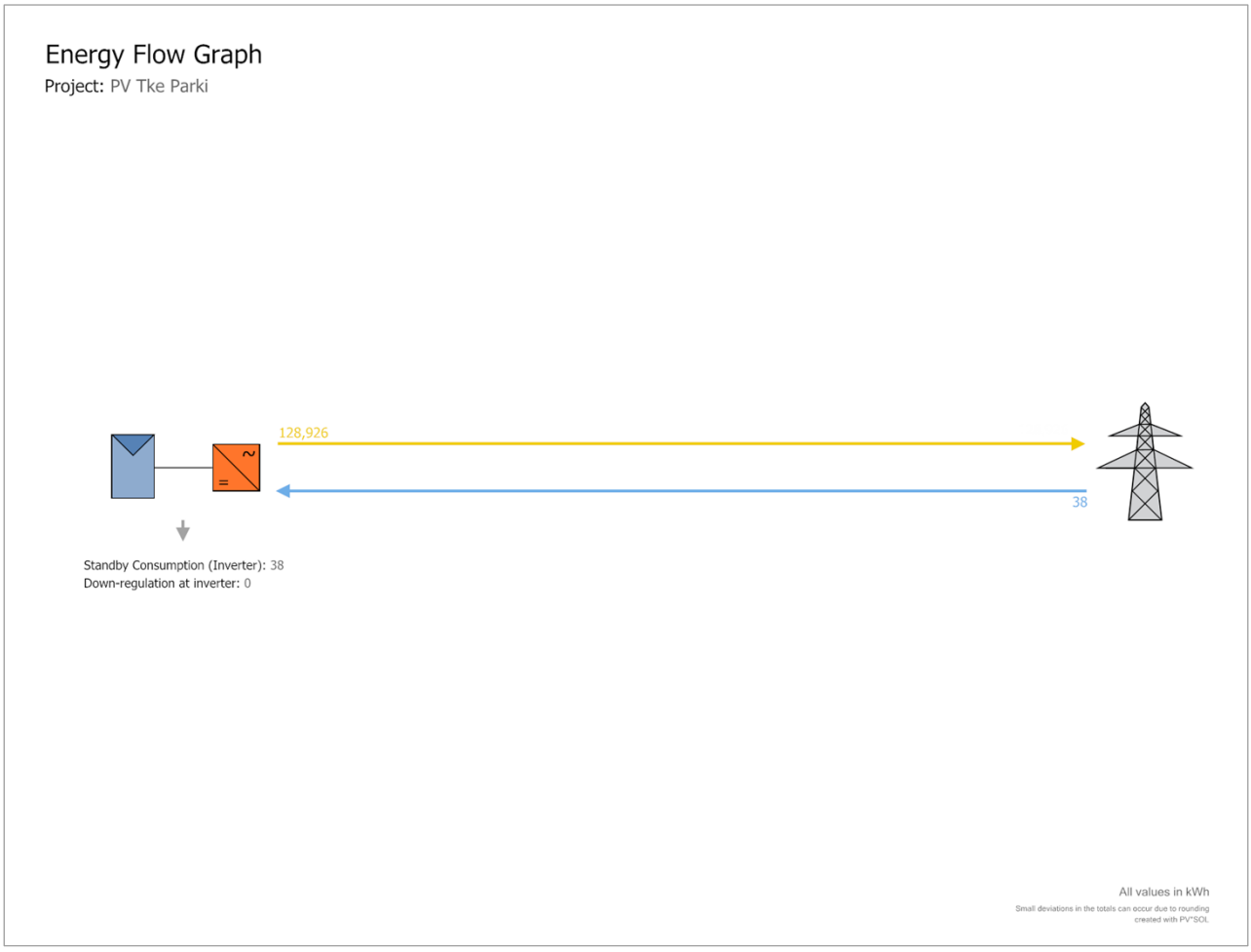


Figure: Energy Flow Graph

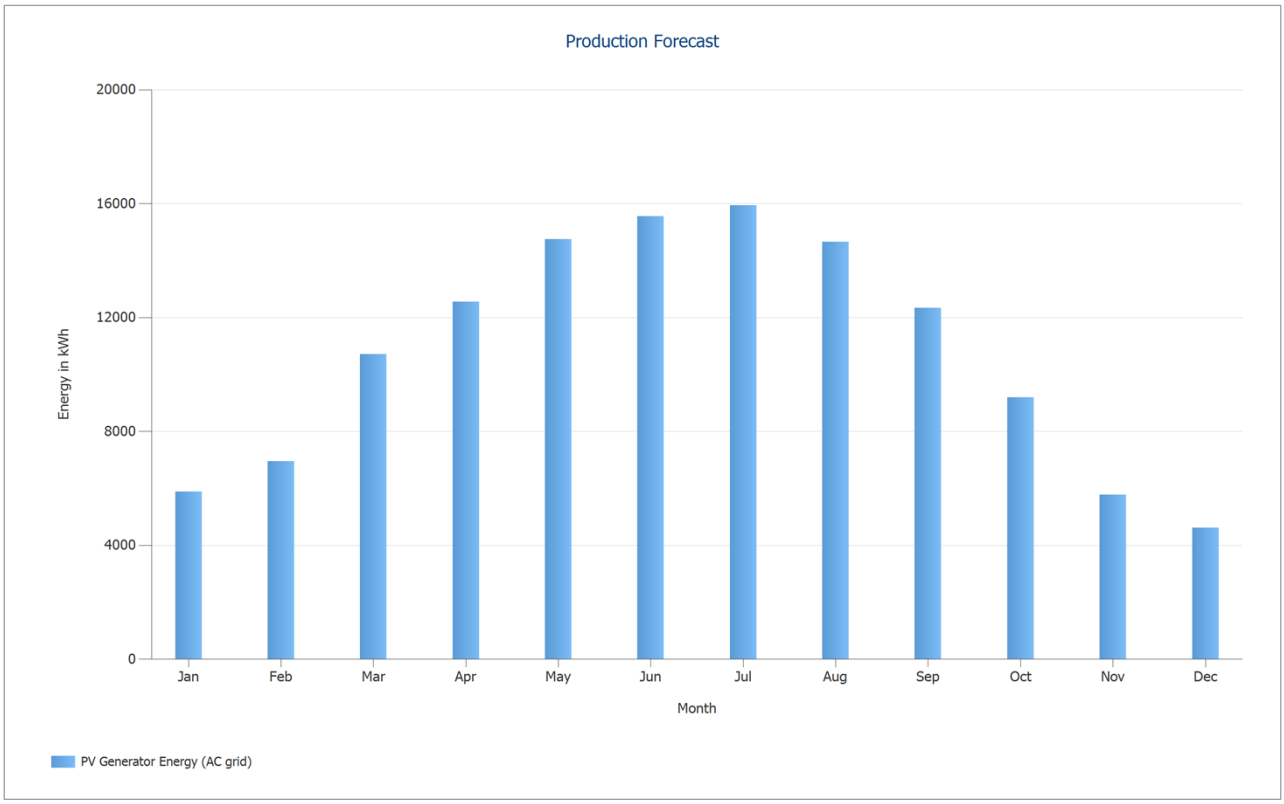


Figure: Production Forecast

Plans

Circuit Diagram

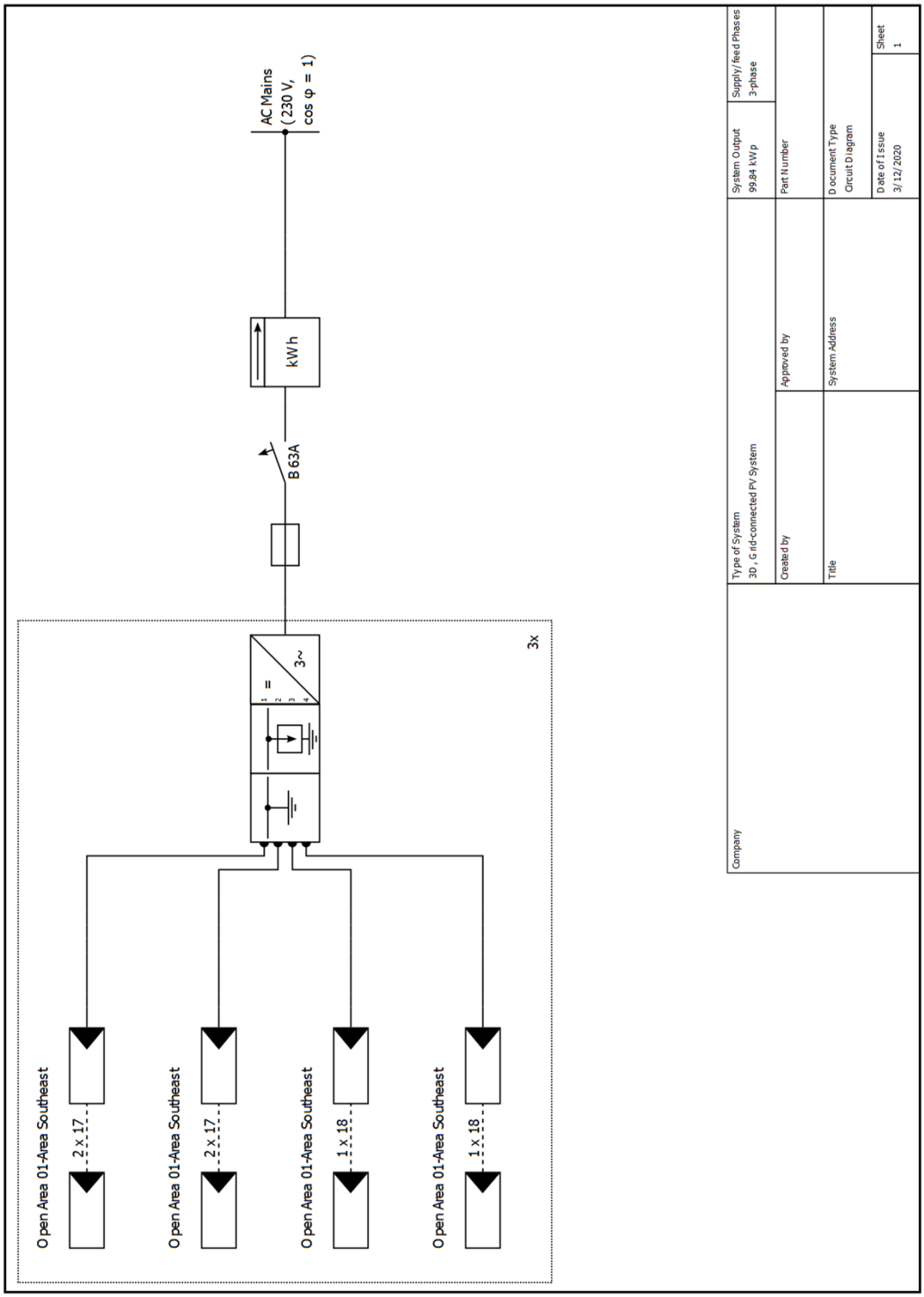


Figure: Circuit Diagram

Dimensioning Plan

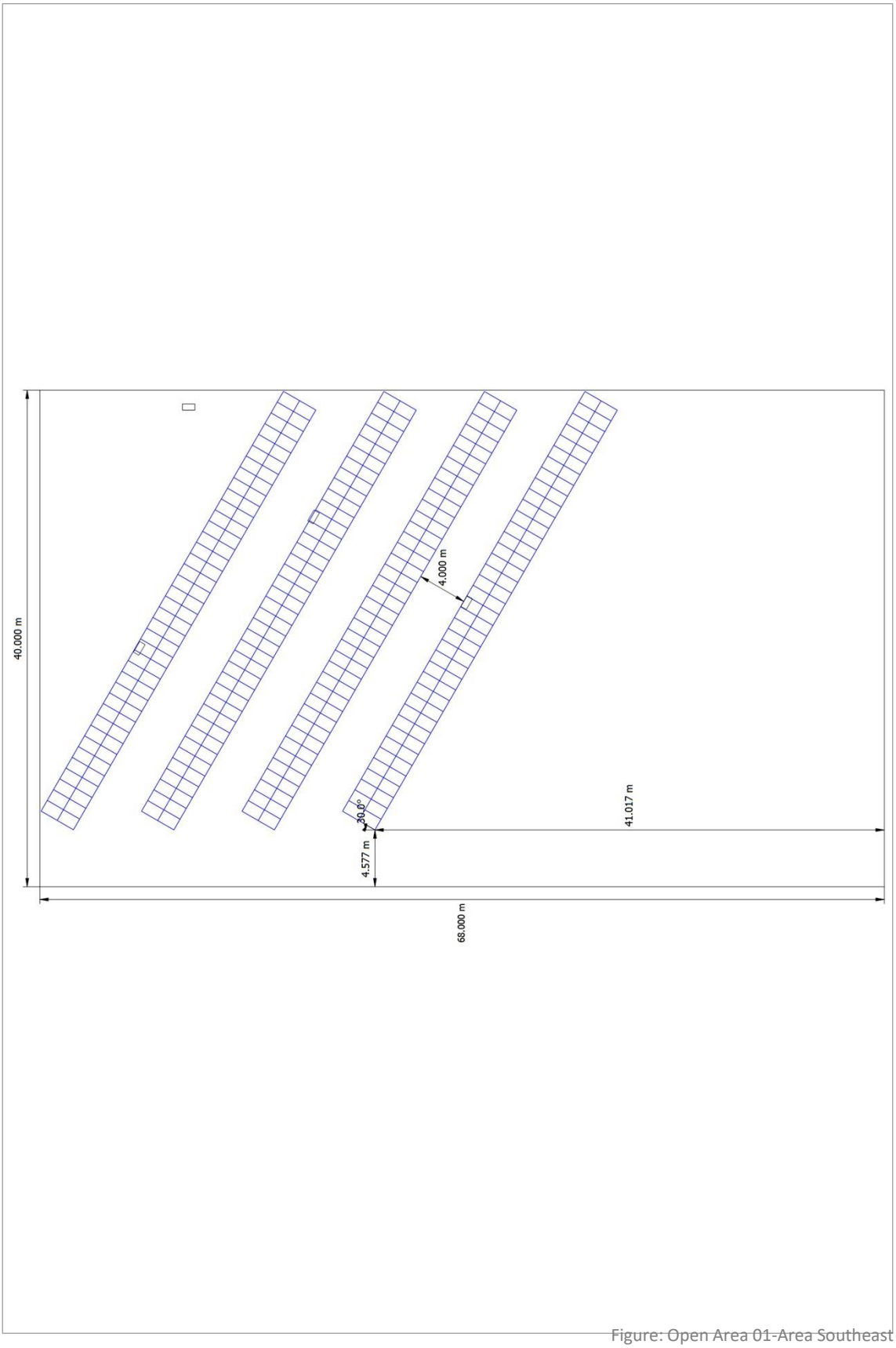


Figure: Open Area 01-Area Southeast

Screenshots, 3D Design

Environment

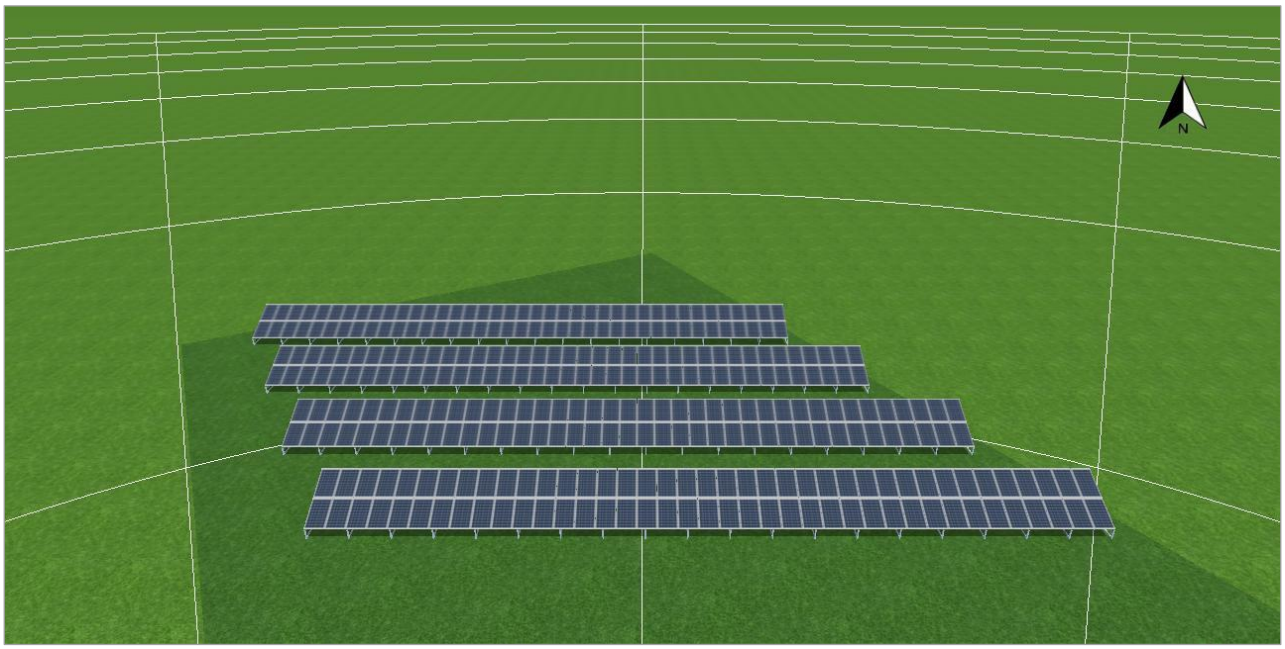


Figure: Screenshot05

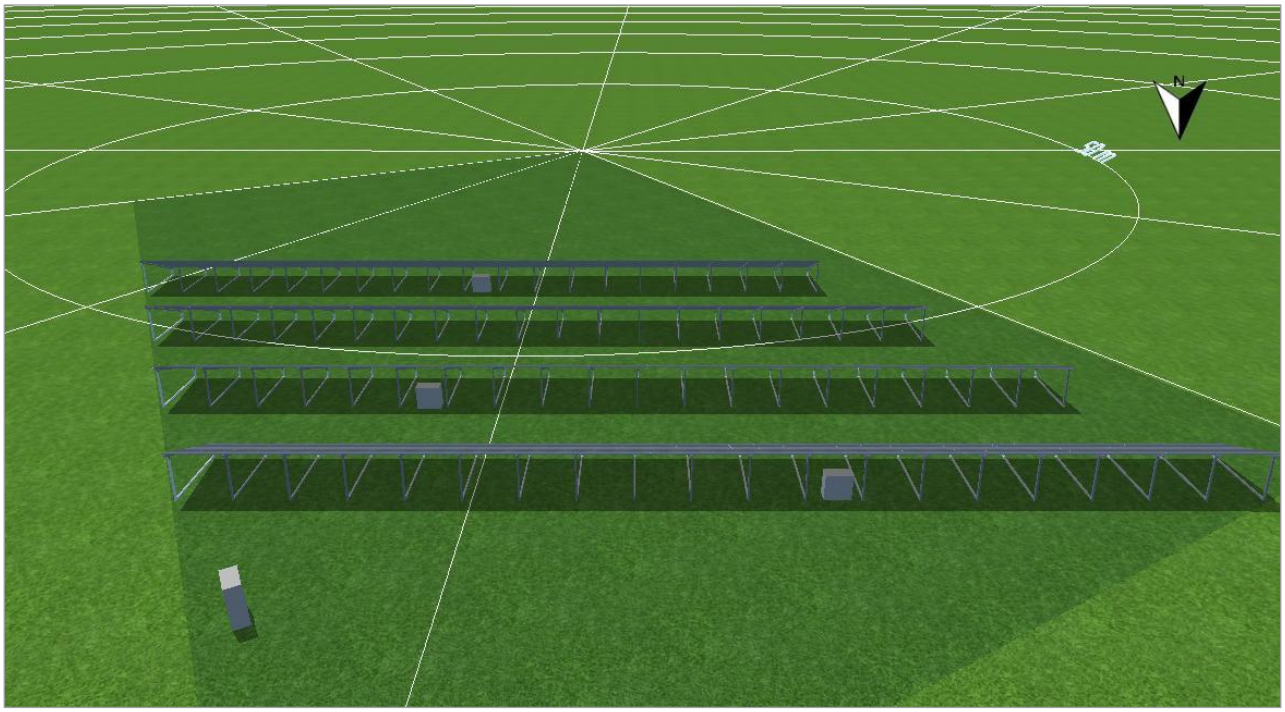


Figure: Screenshot13

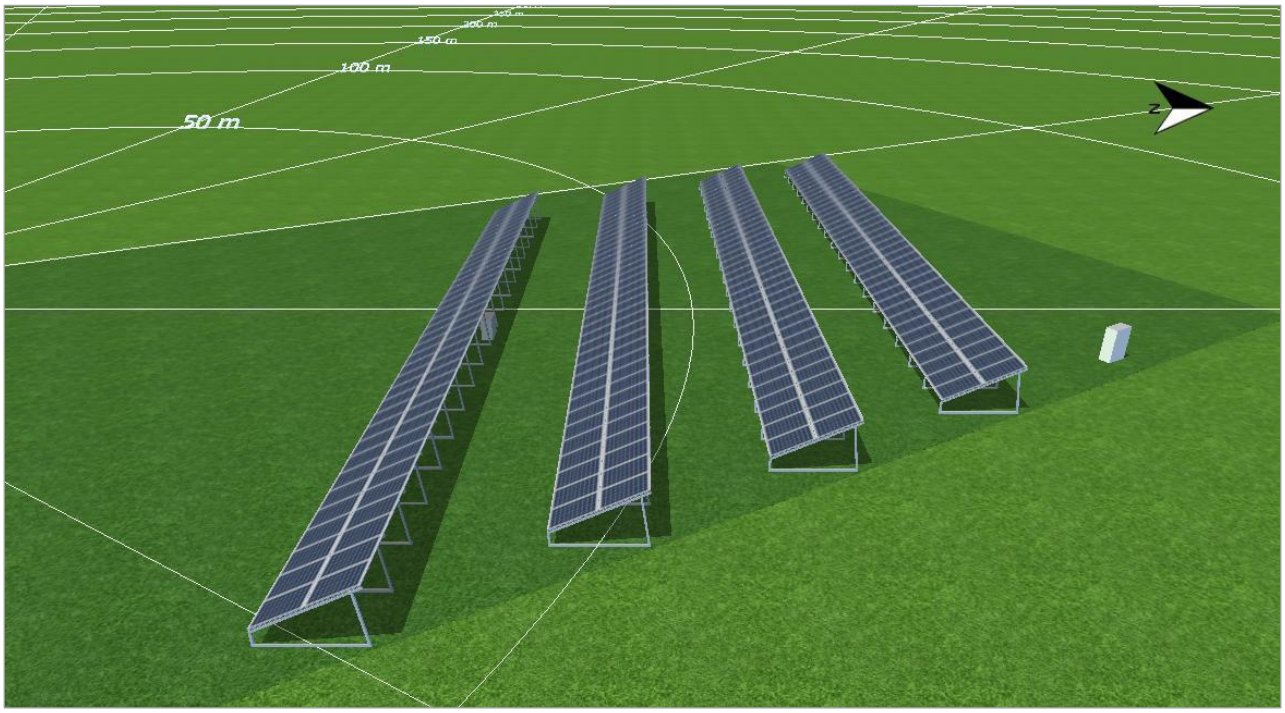


Figure: Screenshot14

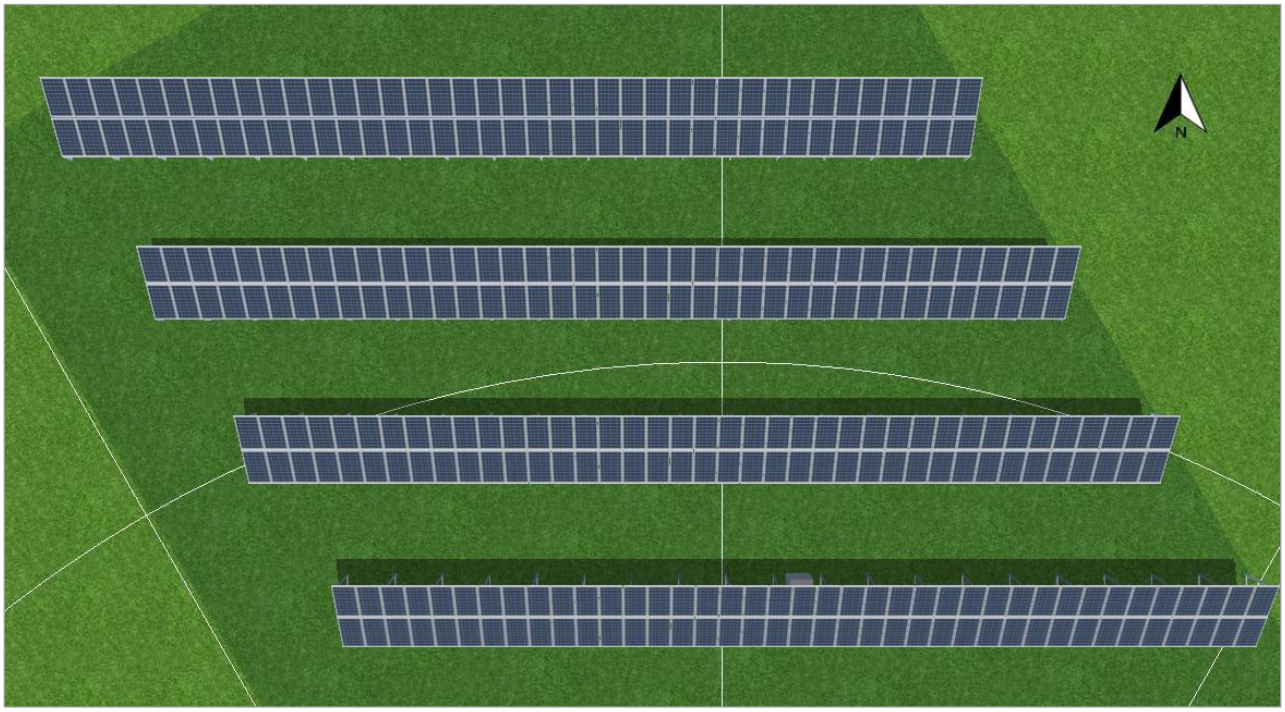


Figure: Screenshot15

Configuration

Figure: Screenshot09

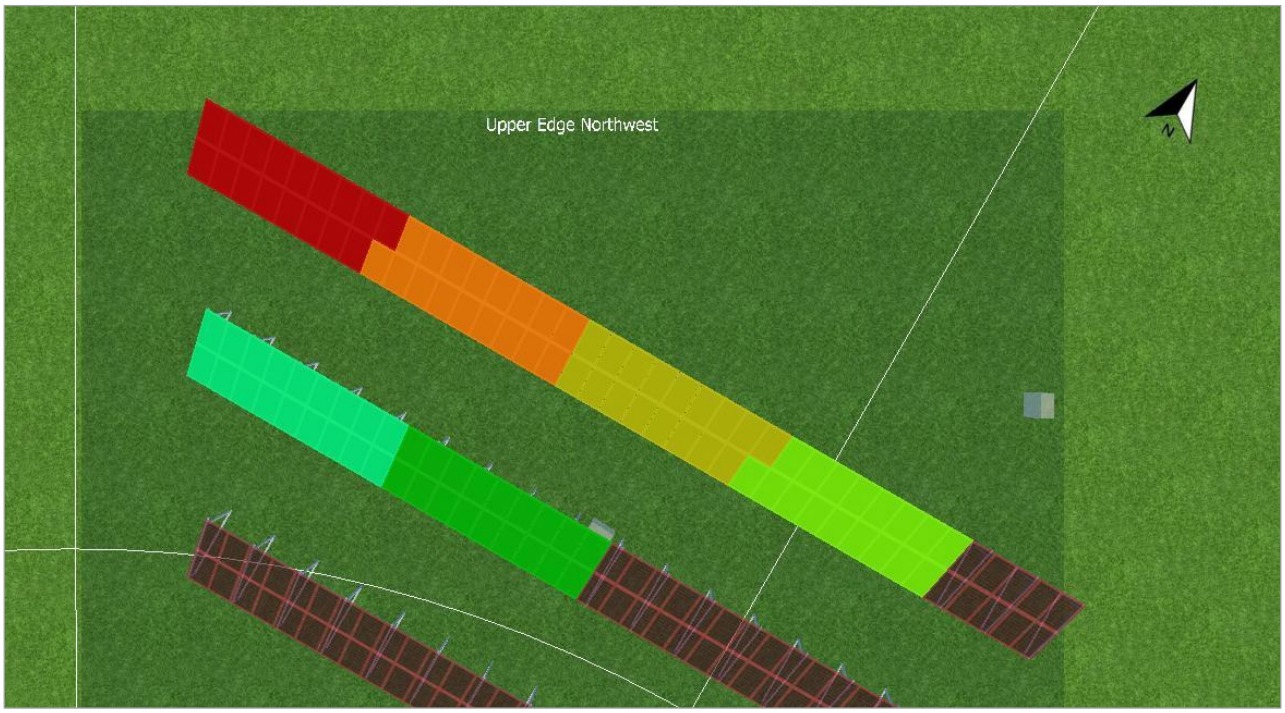


Figure: Screenshot10

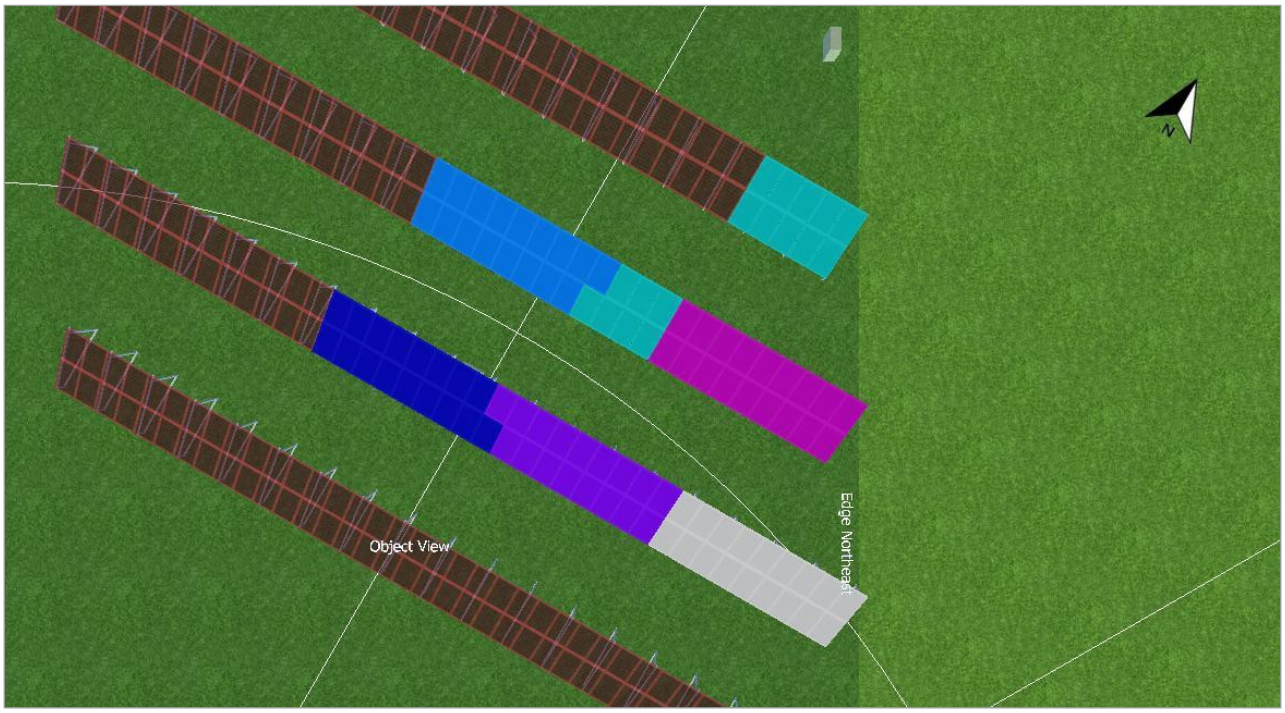


Figure: Screenshot11

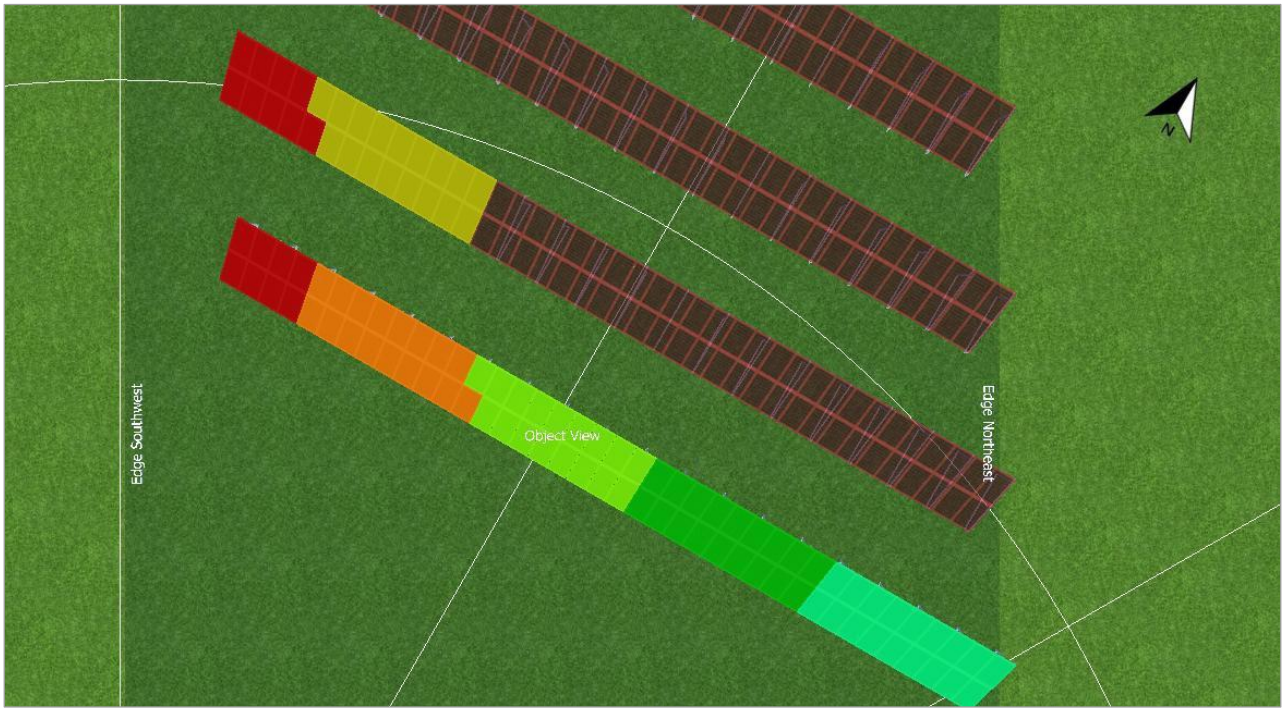


Figure: Screenshot12

Shading

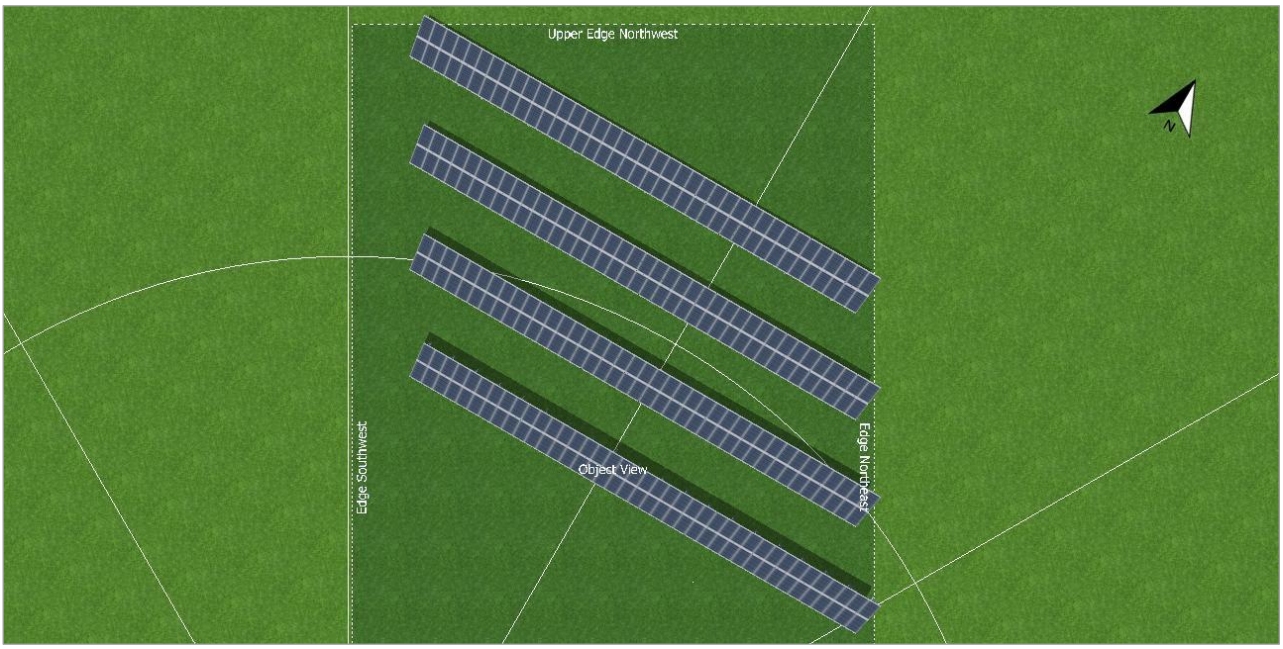
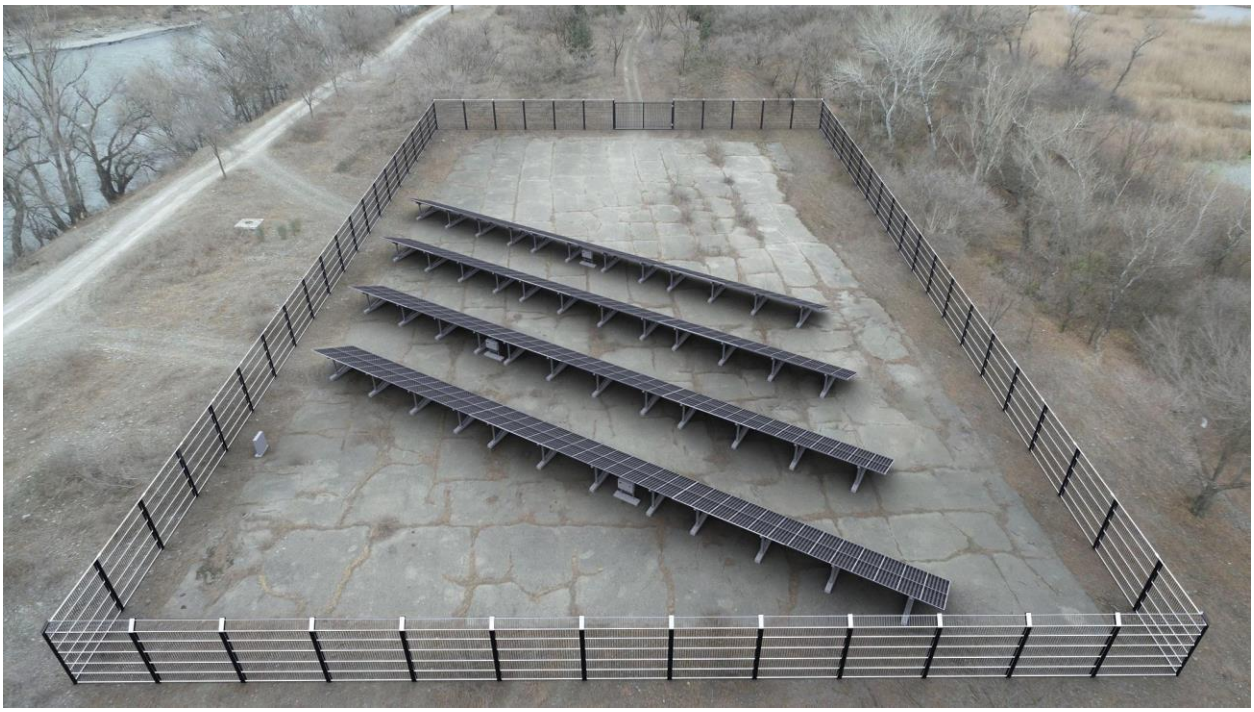


Figure: Screenshot04

Annex 1.2 - Simulation renders for the layout of solar panels in the area



Annex 1.3 - Solar Panel Technical Requirement

Parameters below are set as a minimal standard requirement.

PV Module Data Sheet

PV Module: 320 Watt

Manufacturer	----------.

Electrical Data	
Cell Type	Si monocrystalline
Only Transformer Inverters suitable	No
Number of Cells	60
Number of Bypass Diodes	3

Mechanical Data	
Width	996 mm
Height	1657 mm
Depth	35 mm
Frame Width	35 mm
Weight	18.4 kg
Framed	No

I/V Characteristics at STC	
MPP Voltage	33.17 V
MPP Current	9.65 A
Nominal output	320 W
Open Circuit Voltage	40.78 V
Short-Circuit Current	10.18 A
Increase open circuit voltage before stabilization	0 %

I/V Part Load Characteristics	
Values source	Manufacturer/user-created
Irradiance	200 W /m²
Voltage in MPP at Part Load	32.32 V
Current in MPP at Part Load	1.964 A
Open Circuit Voltage (Part Load)	37.2 V
Short Circuit Current at Part Load	2.16 A

Further	
Voltage Coefficient	-122.34 mV/K
Electricity Coefficient	6.11 mA/K
Output Coefficient	-0.37 %/K
Incident Angle Modifier	98 %
Maximum System Voltage	1500 V
Spec. Heat Capacity	920 J/(kg*K
Absorption Coefficient	70 %
Emissions Coefficient	85 %

Module Efficiency no less than 19.4 %
12-year product warranty
25- **year linear power output warranty**
Solar Panel should have 5 busbar solar cell design
Module Manufacturer should be also the manufacturer of the module cell

Solar Panel parameters below are set as a minimal standard requirement

Certificates

- IEC 61215, IEC 61730
- ISO 9001: 2015 Quality management systems
- ISO 14001: 2015 Environmental management systems
- OHSAS 18001: 2007 Occupational health and safety management systems
- IEC TS 62941: 2016 Terrestrial photovoltaic (PV) modules – Guidelines for increased confidence in PV module design qualification and type approval

OPERATING CONDITIONS

Maximum System Voltage 1000V/1500V DC(IEC)
Operating Temperature -40℃~+85℃
Maximum Series Fuse 20A
Maximum Static Load,Front - 5400Pa
Maximum Static Load,Back - 2400Pa
NOCT - 45±2℃
Application Class – Class A

Annex 1.4 - Inverter Technical Specifications

Efficiency

Item	
Maximum conversion efficiency	Min 98.6%
European efficiency	Min 98.4%

Input

Item				
Maximum input power (cosφ = 1)	Min. 30,600 W			
Maximum input voltage	Min. 1100 V			
Lowest operating/startup voltage	200 V/250 V (200 V[a])			
Highest operating voltage	1000 V			
MPPT voltage range	200–1000 V			

Full Power MPPT Voltage Range	480–800 V
Rated input voltage	620 V
Maximum input current (per MPPT)	22 A
Maximum short-circuit current (per MPPT)	30 A
Maximum inverter backfeed current to the PV array	0 A
Number of inputs	Min. 8
Number of MPP trackers	Min. 4

Output

Rated active power	Min.30,000 W
Maximum apparent power	Min. 33,000 VA
Maximum active power[a] ($\cos\varphi = 1$)	Min. 30,000 W

Rated output(phase/line voltage)	230 V/400 V, 3W+(N)C+PE
Adapted grid frequency	50 Hz/60 Hz
Maximum output current	48 A (400 V)
Power factor	0.8 leading... 0.8 lagging
Maximum total harmonic distortion (rated power)	< 3%

Protection

Input DC switch	Supported
Anti-islanding protection	Supported
Output overcurrent protection	Supported
Input reverse connection protection	Supported
PV string fault detection	Supported
DC surge protection	Type II
AC surge protection	Type II
Insulation resistance detection	Supported
Residual current monitoring unit (RCMU)	Supported

Communication

Display	LED indicator, Bluetooth module+app, USB data cable+app, and WLAN module+app
RS485	Supported
MBUS (PLC)	Supported

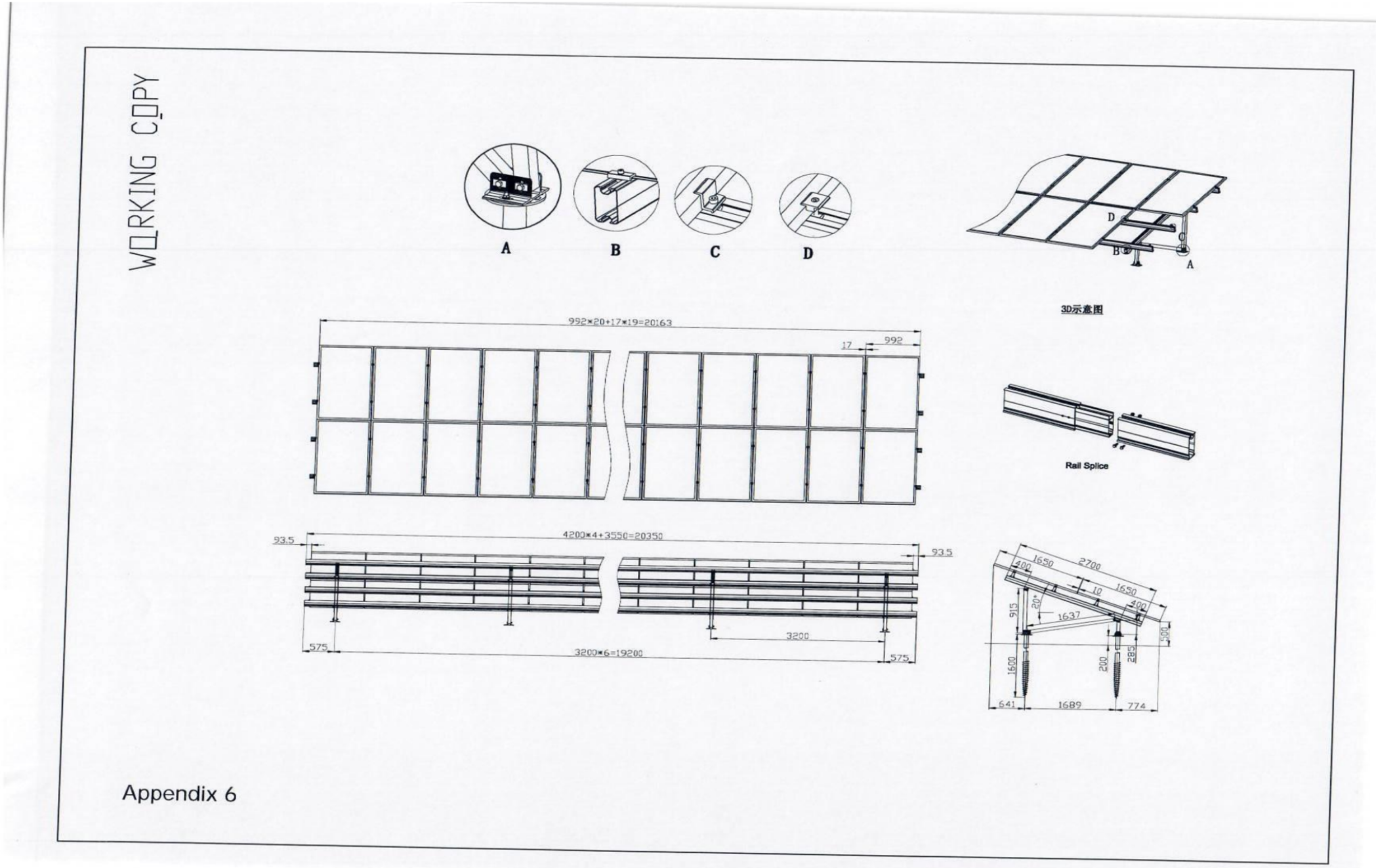
Common Parameters

Mounting	Should be outside mountable
Net weight	----------
Operating temperature	–25℃ to +60℃
Cooling mode	Natural convection
Highest altitude	Min. 4000 m
Humidity	0%–100% RH
Input terminal	Amphenol Helios H4
Output terminal	Waterproof cable connector+OT/DT terminal
Ingress Protection Rating	IP65
Topology	Transformerless

Safety/EMC	EN 61000-3, EN 61000-6, EN/IEC 62109-1, EN/IEC 62109-2, IEC 60529
Grid Code	IEC61727, IEC62116, IEC 61683, IEC 60068-2, EN50438, CGC/GF 035-2013, GB/T 19964-2012, NB/T 32004-2013, VDE-AR-N4105, VDE0126-1-1, BDEW 2008, G59/3, AS4777, UTE C 15-712-1, C10/11, RD1669, PEA 2013, Resolution No. 07, NRS 097

Inverter Warranty should not be less than 10 years.

Annex 1.5 - Drawings of solar panel stand



Annex 1.6 - Requirements for solar panel stand

Technical specifications	
Table design:	2 module in portrait in top of each other
Table inclination:	25°
Table length for each row:	According to the PV Project
Height of bottom edge of table:	According to the PV Project
Distance of piles and rafters:	According to the PV Project
Cross section profiles:	According to the PV Project
Material of piles and rafters:	galvanized steel
Material of mounting profiles and clamps:	aluminum extruded
Material of fastening elements:	aluminum extruded
Wind load:	30m/s
Snow Load	50cm

Annex 1.7 - Requirements for solar cable

For connecting the PV system strings to each other and to the inverter, special solar cable should be used. The. Solar Cable should have following specification

Cross selection	6mm2
Standard / Approbiations	DIN EN 50618; TÜV
Conductor	E-Cu tinned acc. IEC 60228 Class 5
Insulation	Crosslinked special Polyolefin
Sheathing	Crosslinked special Polyolefin
Continuity of marks	≤ 550 mm
Sheat colour	Black
Expected period of use	***25 years***
Rated Voltage U0/U	1,0/1,0 kVAC 1,5/ 1,5 kVDC
Max. permissible operating voltage	1,2/ 1,2 kVAC 1,8/ 1,8 kVDC (conductor-conductor, not earthed system, unloaded circuit)
Current carrying capacity	acc. to EN 50618, table A-3
Resistance of the conductor	EN 50395 clause 5 acc. to EN 50618, table 2
Voltage test on the completed cable with AC or DC	EN 50395 clause 6 (6,5 kVAC or 15 kVDC; 5 min)
Surface resistance	EN 50395 clause 11
Insulation resistance	EN 50395 clause 8.1 performed at 20 °C & 90 °C in water results acc. to EN 50618, table 1
Spark test	EN 62230
Long term resistance of insulation to DC	EN 50395 clause 9 (10 days, 85 °C in NaCl 3 %, 1,8 kVDC)
Properties before ageing	EN 60811-1-1; EN 60811-1-2 (tensile strenth insulation ≥ 6,5 N/mm² tensile strenth jacket ≥ 8,0 N/mm² elongation at break ≥ 125 %
Hot Set test	EN 60811-2-1 (200 °C; 15 min. under load; 20 N/cm² stress)
Bending radius	≥ 4 x outer diameter
Dynamic penetration test	acc. to EN 50618 - Annex D
Ambient temperature in operation	-40 °C to + 90 °C
Min. ambient temperature for installation	-25 °C
Min. allowable ambient temperature	-40 °C
Max. temperature at conductor	120 °C, based on EN 60216-1 (20.000 h; 50 % residual elongation)
Short-circuit temperature	+250 °C (max. 5 sec on conductor
Damp heat test	EN 60068-2-78 (1.000h at 90 °C and 85 % relative humidity)
Shrinkage test	EN 60811-503 (120°C, 1h, shrinkage <2,0%)
Cold bending test	EN 60811-504 (-40 °C, duration of conditioning: 16 h)
Cold elongation test	-40 °C ± 2 °C, duration of conditioning: 16 h)
Cold impact test	EN 60811-506 and EN 50618, Annex C (-40 °C; mass of hammer 1.000 g)

Construction product regulation (CPR)	class Eca in accordance with EN 50575:2014
Resistance against acid and alkaline solution	EN 60811-404 7 days; 23 °C (N-Ocalic-acid; N-Sodium hydroxide solution)
Ozone resistance on completed cable	EN 50396 clause 8.1.3, method B
Weathering/ UV-resistance on sheath	EN 50618, Annex E EN 50289-4-17, method A (720 h; 60 °C ± 3 °C; 50 ± 5 % relative humidity)
Test for vertical flame propagation on complete cable	EN 60332-1-2
Smoke emission of complete cable	EN 61034-2 (light transmittance > 80 %)
Assessment of halogens / Determination of halogens - Elemental test	

Annex 1.8 - The technical requirements for MC4 coupling

For connecting the PV Solar cable, usage of MC4 connectors is a

must. MC4 connectors should have following specification:

Rated voltage	1000 V DC
Rated current (30 °C)	6.0 mm²/10 AWG 65 A
Rated surge voltage	12 kV
Ambient temperature range	-40 °C…+85 °C
Upper limiting temperature	105 °C
Mating cycles	100
Degree of protection, mated	IP65
unmated	IP2X
Overvoltage category/Pollution degree	CATIII/3
Contact resistance of plug connectors	≤ 0.35 mΩ
Locking system	snap-in/locking type
Safety class	II
Contact system	MULTILAM
Type of termination	Crimping
Contact material	Tin-plated copper
Warning	Do not disconnect under load
Insulation material	PC/PA
Flame class	UL94-V0

Norms and standards

IEC 61984:2008 Connectors - Safety requirements and tests

IEC62852:2014 Connectors for DC-application in photovoltaic systems. Safety requirements and tests

IEC60664: Insulation coordination for equipment within low- voltage systems

IEC 60512-5-2:2002 Connectors for electronic equipment - Tests and measurements - Part 5-2: Current-carrying capacity tests- Test 5b: Current-temperature derating

IEC 60364-5-52:2009 Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems

IEC 60947-1 (Low-voltage switchgear and control gear-Part 1: General rules).

UL 6703:2014 Standard for Connectors for Use in

Photovoltaic Systems

DIN VDE 0100-520:2013-06 Low-voltage electrical installations - Part 5-52: Selection and erection of electrical equipment - Wiring systems (IEC 60364-5-52:2009, modified + Corrigendum Feb.

2011); German implementation HD 60364-5-52:2011

DIN VDE 0250-602:1985-03 Cables, wires and flexible cords for power installation; special rubber-insulated single-core cables

UL 1977:2016 Standard for Component Connectors for Use in Data, Signal, Control and Power Applications

UL 2237:2018 Outline of Investigation for Multi-Point Interconnection Power Cable Assemblies For Industrial Machinery

UL 2238:2011 Standard for Cable Assemblies and Fittings for

Industrial Control and Signal Distribution

UL 486a,b: wire connectors

EN 50525-2-31:2011, Part 2-31: Power cables for general applications - Conductor and wiring lines with thermoplastic PVC insulation

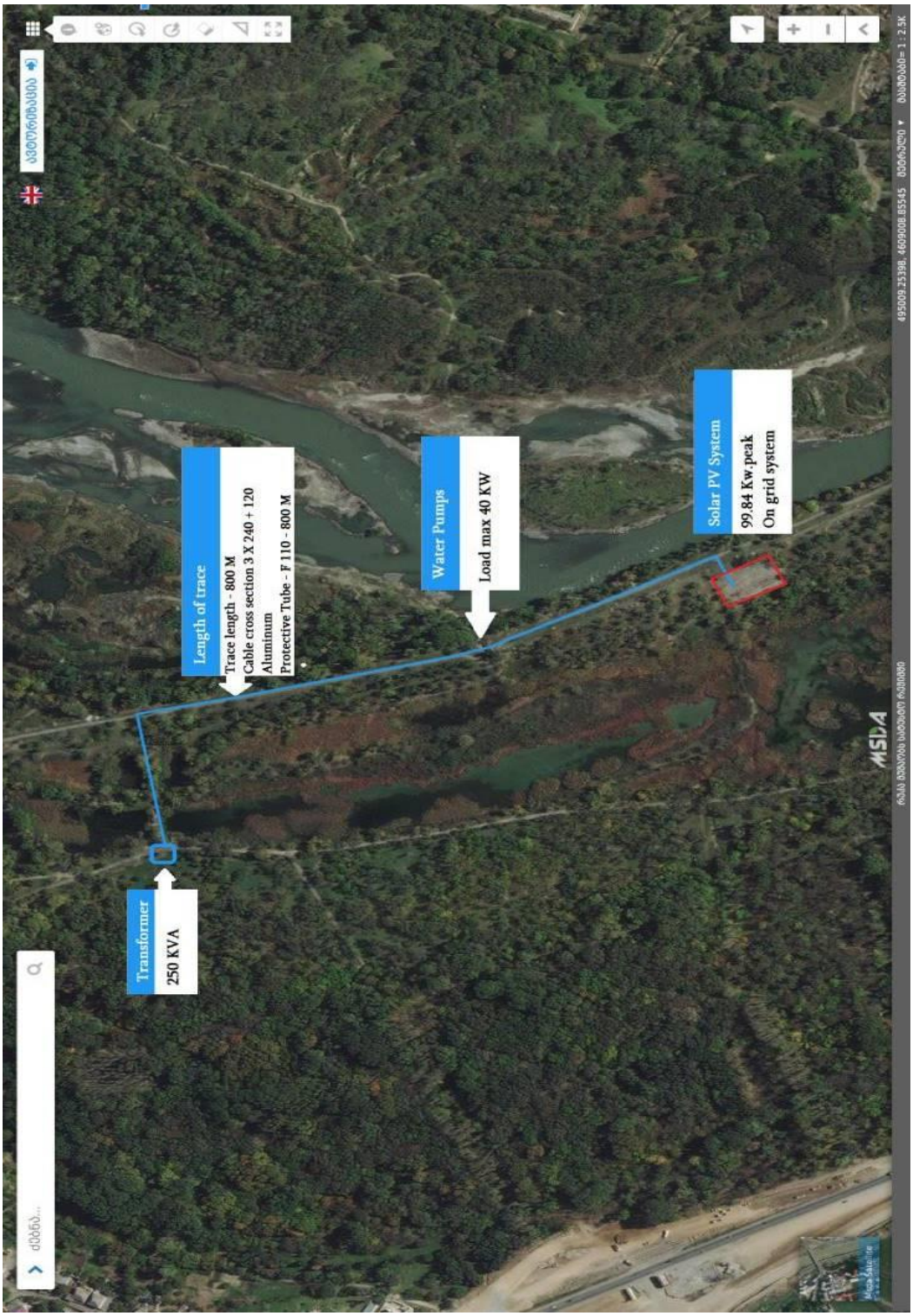
Annex 1.9 - Requirements for AC cable

Inverters should be connected to the AC combiner box, with aluminum ground wire cable

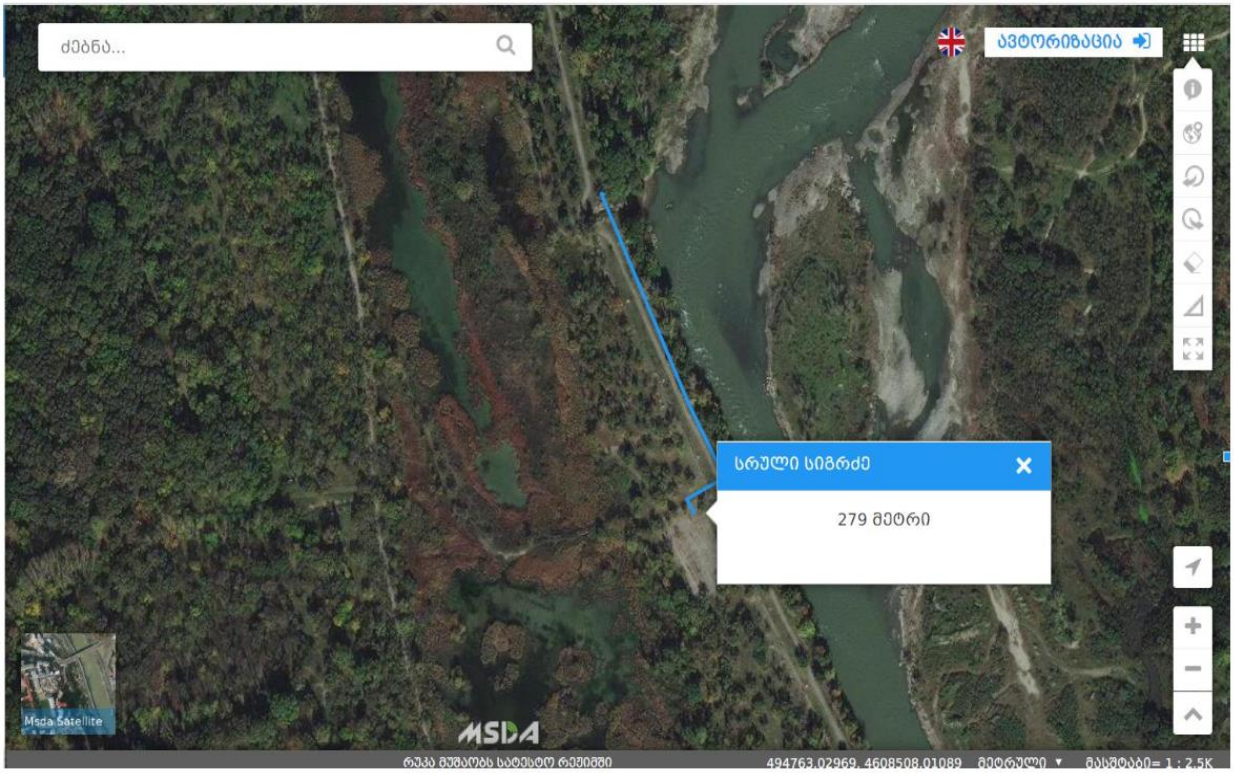
It should have following specifications:

Insulation Material:	PVC
Sheath Material:	PVC
Material Shape:	Round
Wire Core Material:	Aluminium
Certification:	ISO, CCC
Model:	Nayy-J / Ayy / A2xy
Working Voltage:	600/1000 Volts
Test Voltage:	4000 Volts
Standard:	IEC 60502
Specification:	4X240mm2+120
Flexing bending radius:	15 x Ø
Static bending radius:	12 x Ø
Flexing temp:	-5º C to +50º C
Static temp:	-40º C to +70º C
Flame retardant:	IEC 60332.1
Insulation resistance:	> 100 MΩ x km

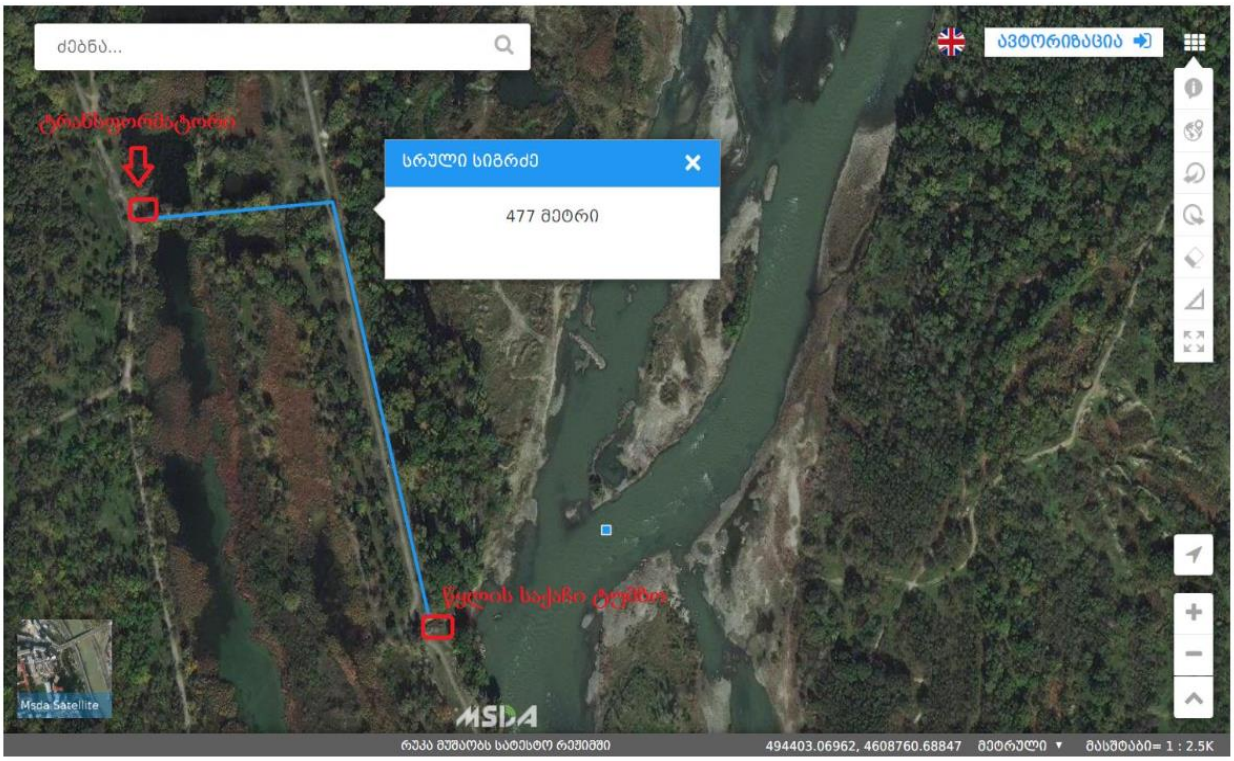
Annex 1.10 - The drawing of the grid to be arranged in the area and cable parameters



Cable length from power plant to water pump 279m



Cable length from water pump to transformer 477m



Annex 1.11 - The electrical circuit of the water pump equipment cabinet