

**Appendix to  
Call for Service for PV Installations Mounting and Service Providers**

**FSM-2024-11-08**

**FUNCTIONAL PROGRAM**

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<b><i>Title of the Tender:</i></b>
<b>Designing And Constructing of Photovoltaic Installations With Their Servicing In The Municipality Of Tkibuli, Georgia</b>
The Area of Tender Implementation: The Municipality Of Tkibuli, Georgia
Common Dictionary Of Public Tenders:  45311200-2 Works in the scope of electrical installations 45311000-0 Works in the scope of wiring and electrical installations 71320000-7 Engineering services in the scope of designing 51000000-9 Installing services (excluding computer programming) 09331200-0 Solar photoelectric modules 31600000-2 Electric equipment and apparatus
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Tkibuli, 16.11.2024 r.

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# 1. Description Part

## 1.1 The Subject of the Tender

The subject of this tender procedure is designing and constructing of two photovoltaic installations for two kindergartens in the municipality of Tkibuli, Georgia, in the „Design and Construct” formula, as well as their latter servicing during 10 years.

The Project is co-financed within the framework of the Polish development cooperation of the Ministry of Foreign Affairs of the Republic of Poland.

The scope of the tender also includes the activations of PV installations on the selected objects of Tkibuli municipality, as well as delivery and activation of energy production monitoring system for each of the installations.

### **1.1.2 Designing and Constructing of two photovoltaic installations on selected objects of Tkibuli municipality (Tkibuli Kindergarten No. 6 and Akhalsopeli Kindergarten), of total energetical power proposed by the Contractor, within the remuneration described in Call for Service FSM-2024-11-08, according to the content of this Functional Program (FP)**

The Installations shall be designed and constructed according to the requirements described in Section 1.3.1 of FP.

### **1.1.3 As-built documentation** – recording format \*.pdf, \*.shp, \*.xlsx or another commonly used and publicly available format, including detailed inventory of newly built PV installations

### **1.1.4 Servicing of the installations during 10 years** – according to the requirements described in Section 1.3.2 of FP.

The Subject of the Tender also includes:

- 1) activation of electrical energy production in the PV installations and introducing of the energy into the network grid;
- 2) delivery of all necessary certificates, declarations, confirmations etc.,

The materials used for the implementation of the tender subject shall meet the requirements of the Construction Act of July, 7, 1994 (uniform text Dz. U. of 2016, pos.. 290 with latter changes), the Construction Products Act of April, 16, 2004 (Dz. U. Nr of 2014, pos. 883.) and the Conformity Assessment System Act of August, 30, 2002 (Dz. U. of 2014, pos. 1645).

The Ordering Party decided to prepare the guidelines for tenderers in the form of this Functional Program to facilitate the implementation of the investment regarding expectations and requirements known to all of the participants. Thus the Ordering Party states the declared technical and functional level of solutions which are going to be the subject of the proposed offers delivered by tenderers.

## 1.2 Requirements towards the subject of the tender

### 1.2.1 Requirements towards documentation:

- The Ordering Party shall transfer the whole possessed documentation concerning the tender to the Contractor chosen in the procedure.
- The Contractor shall deliver technical instructions of mounted units for the needs of maintenance and exploitation – when needed.

- The Contractor shall prepare such amount of specific design studies as is necessary to achieve required opinions, approvals and decisions, and for the implementation of the tender's sake.
- And any other required by the law and regulations information or documents.

## **1.2.2 Requirements towards implementation**

a) Designing and constructing of two PV installations on selected objects of Tkibuli municipality, of total powers below 50 kWp each

PV installations on the roofs shall consist of dedicated supporting constructions in the southern or other pointed directions, and specified maximal numbers of modules and inverters, described in Section 1.3.1 of FP.

The Contractor shall secure the constructing area. The constructing of installations shall be in accordance to the applicable regulations, and the Construction Act in particular. The Contractor shall possess necessary experience and executive potential,

The Contractor shall prepare projects of temporary traffic organization – if needed.

The works shall be conducted according to applicable regulations, norms and modern technical knowledge rules.

The Ordering Party requires that the Contractor shall apply for the construction permit and necessary approvals – if needed.

Before applying for the construction permit the Contractor shall obtain the approval of the Ordering Party in the scope of proposed technical solutions and materials, as well as the approval of the grid operator in the scope of compliance with technical connection conditions. The Contractor shall apply to the authorities for the use permit after realization of the subject – if needed.

Any changes of technical solutions, previously aligned with the Ordering Party, need further agreement.

Preparing As-built documentation.

## **1.2.3. As-built documentation**

The As-built documentation shall be delivered in recording format of \*.pdf, \*, \*xlsx or other commonly used and publicly available format, and consist of detailed inventory of mounted PV modules, inverters, wiring and supporting constructions, as well as other elements of energetical infrastructure being a component part of the PV installations.

The Ordering Party shall carry out final acceptance after completion of investment.

At the final acceptance the Contractor shall pass to the Ordering Party the complete set of acceptance documents together with As-built documentation.

## **1.3 Requirements towards equipment, materials, and apparatus**

### **1.3.1 Designing and Constructing of two photovoltaic installations on selected objects of Tkibuli municipality of total powers below 50 kWp each**

#### **General requirements:**

**The parameters of high class PV bifacial modules shall possess and reflect the following technical traits:**

- Modules of minimal power of a single unit **not lower than 550 Wp +/-10%**; the yearly energy production from one module not lower than 680 kWh +/-10%;
- Yearly energy production from one module at the end of lifetime period (at least 30 years) not lower than 85% nominal efficacy;
- Each module shall possess the certificate of compliance with current standards, in particular with IEC 61215, IEC 61730, IEC 62716 and IEC 61701;

- Each module shall possess positive power tolerance in the range of 0-5 W. the modules must be brand new and come from current production, which means not older than 6 months before delivery to be mounted;
- Together with modules the Contractor shall deliver the list of flash tests in paper or electronic version, and manufacturer's warranty with the required minimal 85% of nominal efficacy after 30 years since delivery date.

The Ordering Party shall allow **ONLY bifacial monocrystalline modules**, produced by manufacturers present at the market for at least 15 years (the condition necessary to confirm the length of warranty period). The manufacturers of modules must be classified and present on **Bloomberg's List Tier 1 Bloomberg** in 2024 – the ranking developed by Bloomberg New Energy Finance, allowing to identify those photovoltaic modules manufacturers who offer products of high quality, low failure rate, and advantageous relation between quality and price.

Minimal period of warranty for photovoltaic modules – 10 years.

Maximal period of warranty for photovoltaic modules – 15 years.

Minimal period of warranty for modules efficacy – 25 years.

Maximal period of warranty for modules efficacy – 30 years.

Minimal level of modules efficacy after warranty period – 85%.

Maximal level of modules efficacy after warranty period – 90%.

The warranty period of PV modules is a point criterion, so it has to be confirmed by technical data sheets from the manufacturers. Those data sheets must be also present on the website of the manufacturers.

Minimal parameters of modules in STC - standard conditions (AM 1,5; 1000W/m<sup>2</sup>; 25°C):

Power in STC	Pmax[W]	550,00
Power tolerance	%	-0 / +5
Power in NOCT	Pmax[W]	416,40 +/-5%
Open circuit voltage	Voc[V]	50,0 +/-5%
Maximum power voltage	Vmpp [V]	42,0 +/-5%
Short circuit current	Isc[A]	13,8 +/-5%
Maximum power current intensity	Impp[A]	13,0 +/-5%
Fill factor	FF [%]	76,0 +/-5%
Module efficacy	[%]	21,0 +/-5%
Number of cells	szt.	144 +/-5%
Static mechanical load capacity	Pa/m <sup>2</sup>	5400
Dynamic mechanical load capacity	Pa/m <sup>2</sup>	2400
Temperature factor for Pmax	% /°C	-0,350%/C
Module weight max	kg	Max 1 kg/20Wp +/-5%

## Minimal requirements in the scope of photovoltaic inverters

The number of inverters should be selected taking into account their rated power, so that the total rated power of the inverters should not be greater than the specified power for a given installation and not less than 80% of the kW AC power. The inverter manufacturer's recommendation should be taken into account. The Contractor will confirm the correctness of the selection of inverters for the connected modules with a statement from the designer about their optimal configuration..

Additionally, each inverter must be equipped with a WI-FI/LAN interface enabling monitoring of the PV installation and showing the current energy production on individual installations (separately for each of them) and the total energy production in order to control the amount of energy produced. Viewing the above parameters should be possible on the manufacturer's platform or a dedicated user page of the system.

Minimal warranty period for photovoltaic inverters – 10 years.

Maximal warranty period for photovoltaic inverters – 15 years.

The warranty period of inverters shall be confirmed by technical data sheets from the manufacturers. Those data sheets must be also present on the website of the manufacturers.

Minimal technical requirements for inverters:

Maximum DC voltage	U <sub>max</sub> [V]	1100
DC Overvoltage protection		TYPE II
AC Overvoltage protection		TYPE II
Protection against DC current in the AC network		Differential circuit breaker (RCD)
Communication		RS485/PLC
Maximum efficacy	[ % ]	99,0
European efficacy (weighted)	[ % ]	98,2
Topology		Three-phase/ transformerless
Cooling		convective (natural)
Security		reverse polarity protection, short circuit protection, island protection, DC disconnect
Protection indicator	IP	65

The devices used must comply with applicable laws, technical standards, directives and requirements of the relevant Distribution Network Operator to whose network the photovoltaic installations will be connected.

Compliance of devices with applicable European directives and standards:

- a) Compliance with Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (LVD) and the harmonized standards therein:

- PN-EN 62109-1:2010 "Safety of power converters used in photovoltaic energy systems - Part 1: General requirements"
  - PN-EN 62109-2:2011 "Safety of power converters used in photovoltaic energy systems - Part 2: Particular requirements for inverters"
  - b) Compliance with Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonization of the laws of the Member States relating to electromagnetic compatibility (EMC) and the harmonized standards therein:
    - PN-EN 61000-3-11:2004 "Electromagnetic compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems - Equipment with rated current  $\leq 75$  A subject to conditional connection"
    - PN-EN 61000-3-12:2012 "Electromagnetic compatibility (EMC) - Part 3-12: Limits - Limits for harmonic current emissions for equipment with rated phase current  $> 16$  A and  $\leq 75$  A connected to the public low-voltage supply network"
  - c) Compliance with the standard PN-EN 50438:2014-02 (or the European version EN 50438:2013) "Requirements for microgeneration installations intended for parallel connection to public low-voltage distribution networks", which sets out requirements to ensure correct cooperation of micro-installations with the energy system;
  - d) Compliance with Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).
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Each inverter input on the DC side and the AC side should be protected against the effects of surges. For this purpose, surge protection should be used. This also applies to the digital inputs and outputs of the data lines.

#### **Minimal requirements for materials and supporting constructions.**

Two-support, prefabricated steel-galvanized structures are planned, hereinafter referred to as photovoltaic tables. The contractor can also select another solution, guaranteeing the stability of the panel mounting and the durability of the structure.

Characteristics of basic elements of supporting construction:

- Stainless steel screws, fasteners and nuts, aluminum or stainless steel clamps;
- Mounting frames must be compatible with the panels, i.e. not cause damage or deformation;
- The Contractor shall provide protection against electrochemical corrosion that may occur at the joint of anodized aluminum and steel.
- Supporting structure calculated for the appropriate snow load class and wind load class confirmed by certificates and tests.

#### **Minimal requirements for electrical circuits, connectors and cable routes.**

##### **DC circuits.**

The photovoltaic modules are planned to be connected in series using cables with tinned copper cores with double insulation made of cross-linked component. DC circuits should be routed inside the C-profiles of the supporting structure, and if necessary, additional galvanized steel ducts should be used. Permanent relationship markers should be placed on the cables.

The inverter connections must be protected from mechanical damage. All wires and cables used to build a photovoltaic installation must have appropriate certificates and documents confirming their compliance with applicable legal regulations and current technical standards.

The cables used for the DC system of the photovoltaic installation must be dedicated to work with direct current and resistant to weather conditions, in particular UV radiation. Single-core

cables in the form of ropes should be used to make connections in photovoltaic installations on the DC side. Cables and wires should be routed in appropriate cable trays or ladders that additionally protect against weather conditions, UV radiation, mechanical damage or accidental interference by outsiders, etc.

- Solar cables with tinned copper core;
- UV resistant with hermetic connectors;
- Core cross-sections selected based on loss optimization so that voltage drops are no greater than 1%;
- Solar cables must be certified for use in photovoltaic installations and have insulation strength at a voltage of 1000V within a temperature range of -40oC to 80oC;
- Photovoltaic panels must be equipped with connectors with a protection degree of at least IP65, e.g. Multicontact MC-4 or equivalent with the same parameters.

### **AC circuits**

The alternating current (AC) cabling shall be carried out in accordance with the arrangements with the Electrical Network Operator.

The cables shall be laid in externally designed cable trays and plastic cable channels attached to the photovoltaic module structure frames. The cable route shall be marked with blue PVC foil (30 cm wide and 0.5 mm thick). The cable bend radii must be in accordance with the cable manufacturer's recommendations. Permanent markers with the description: Owner, cable type, voltage (year of construction) should be placed on the cables. Cables must have a 3% reserve.

### **Detailed requirements:**

#### **Common for all locations:**

Modules: minimal power 550 W, self-cleaning coating, with all certificates allowing for use in Georgia.

Inverters: transformerless, ongrid, inverter efficiency min (EU) - 98.2%, enabling communication via wifi, RS 485, own consumption below 1%.

Supporting structure: certified structure for photovoltaic systems, ensuring full equipotentiality of modules.

Protections: DC side: surge protection, reverse current protection for each circuit, dedicated for DC.

AC side: surge protection, overcurrent protection, differential protection, certified switchboards for DC up to 1000 V, IP 65 tightness class.

An additional automatic switch-disconnector should be provided for the photovoltaic installation, cutting off the voltage supply in the event of starting the generators during a mains voltage failure.

The design of the installation, including the manufacturers of individual components, must be approved by the Ordering Party before the Contractor commences work, under penalty of non-acceptance of the subject of the order.

The Ordering Party shall indicate to the Contractor the place where the installation may be connected to the existing power connection.

### **Remote monitoring of the operation of photovoltaic modules and the entire installation:**

The Ordering Party requires that the photovoltaic installation has the possibility of local and remote monitoring. Local monitoring should be understood as the possibility of monitoring the operation of the PV installation using a dedicated computer that is part of the photovoltaic installation, which should be installed in the existing control room/dispatch room.



The monitoring system selected by the Contractor must ensure the transmission of data from the inverters and the collective measurement point, e.g. at the point of connection of the photovoltaic installation circuits to the Ordering Party's LV switchboard, to the computer in the control room.

Remote monitoring should be understood as the ability to monitor the operation of the photovoltaic installation from any location using the Internet. The Contractor is responsible for providing all devices and components necessary to transmit data from the inverters and the collective control point to a dedicated computer and for ensuring access to this data and its viewing using disk space, servers or a separate platform on the Ordering Party's mobile equipment.

The Ordering Party requires that the monitoring system in terms of functional and utility properties enables:

- Monitoring of instantaneous energy production;
- Graphical presentation of energy production in graphs;
- Reporting — a module enabling the creation of tabular and graphical summaries.

Reporting should be possible for any time period. Various reports and balances should be defined in the system, enabling the analysis of measurement data. The system user should have the functionality to modify or define reports based on the report templates defined in the system.

- Configuration of the measurement system
- The system must enable full representation of the measurement system configuration and the user's free definition of sets and groups consisting of source measurement points.

In addition, the ordering party absolutely requires that:

- The monitoring system interface be in English and Georgian;
- Access to both the local and remote monitoring system for a period of no less than 5 years is free of charge. The Ordering Party allows the use of a paid system provided that the Contractor prepays the service for the installation for a period of 10 years.

It is permissible to change the requirements regarding monitoring capabilities depending on current needs resulting from the content of agreements concluded with the energy recipient.

## **Initial designs of photovoltaic installations**

### **Location 1 – Akhalsopeli Kindergarten**

Investment location (south-east and south-west roofs):

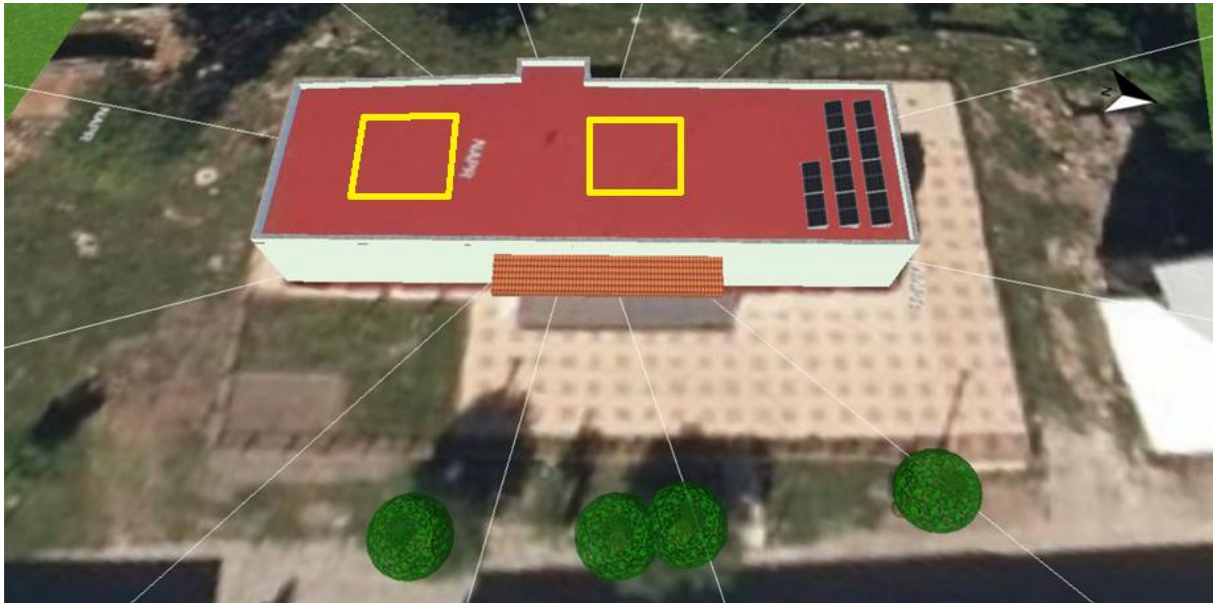


REQUIRED SIZE OF THE PHOTOVOLTAIC SYSTEM - **9,995 kWp (minimal size of the system is 9,95 kWp)**

Estimated minimal yearly production of energy: 12 500 kWh

### Location 2 – Tkibuli Kindergarten No. 6

Investment location (south orientation near existing PV installation of 5,85 kWp powered):



PROPOSED SIZE OF THE PHOTOVOLTAIC SYSTEM ..... kWp

Estimated minimal yearly production of energy: number of kWp x 1 250 kWh

### 1.3.2. Requirements towards servicing and maintaining energy efficiency for the period of 10 years

By performing a photovoltaic service (servicing), the Ordering Party understands the performance of all maintenance works, replacement of devices and elements of PV installations, ensuring continuous production of electricity for the Ordering Party's needs and the efficiency of the delivered PV installations guaranteeing minimum levels of energy yield specified in the PFU and the contractor's offer. During the term of the agreement, the Ordering Party will not incur any additional costs related to maintaining the efficiency of the delivered installations (panels, inverters and other devices and equipment).

By the provision of energy efficiency maintenance services in the scope of photovoltaic installations, the Ordering Party understands the achievement of energy savings resulting from the delivery and commissioning of photovoltaic installations in the form of devices described in item 1.1.1 of the PFU for a period of 120 months from the date of their final acceptance. The savings will be the amount of electricity produced by the installations per year. In case when the minimum annual electricity production volumes declared by the Contractor are not achieved by each of the installations, the Contractor will be obliged to pay compensation to the Ordering Party resulting from the difference between the declared minimum production volume and the actual volume - in an amount constituting the product of the difference in electricity production expressed in kWh per year and the rate paid by the Ordering Party for 1 kWh of energy supplied from the grid.

**In order to secure future claims of the Ordering Party, the Contractor (Tenderer) will pay (deposit) an amount equal to 3% of the order value in cash or in the form of a bank guarantee or insurance guarantee. The security will serve to satisfy the Ordering Party's claims in the event of the Contractor's failure to fulfill the obligations described in the PFU and Call for Service FSM-2024-11-08.**

## **1.4 Conditions of the implementation of the subject of the tender**

- Obtaining all agreements, decisions, geodetic maps for design purposes is the responsibility of the Contractor based on the power of attorney received from the Ordering Party;
- At the design stage, the Contractor is obliged to consult with the Ordering Party and obtain its approval in relation to the offered technical solutions;
- The Contractor will attach to the prepared technical design of the installation a statement that it has been made in accordance with the agreement, applicable regulations, standards and guidelines, and that it is complete from the point of view of the purpose it is to serve;
- The Contractor shall be obliged to provide persons authorized by the Ordering Party with access to the construction site;
- As part of the offered price for the execution of the subject of the order, the Contractor must estimate all costs related to the implementation of the investment resulting from this functional and utility program, related to preparatory and cleaning works, organization of the construction site facilities, reconstruction of the surface, etc.;
- In places where work is being carried out, the area must be restored to its previous condition, removable surfaces must be reconstructed using demolition material, damaged or destroyed elements must be replaced with new ones. Lawns and green areas must be supplemented with humus and sown with grass;
- All materials and devices used to build the designed photovoltaic installations must be brand new and meet the requirements of the Act of 16 April 2004 on construction products;
- All devices must have the CE safety mark and meet the requirements of applicable standards and regulations, in particular the requirements for protection against electric shock,

## **2. Information part**

### **2.1 Appendix list:**

1. Appendix No. 1 - „Cadastral details of 2 Tkibuli kindergartens”

### **2.2. The statements of the Ordering Party**

The Ordering Party declares that the Partner and Beneficiary of the Project – Tkibuli Municipality – has legal title to the buildings and areas described in the preliminary designs of photovoltaic installations, as the area on which the Contractor will be able to design and build future installations.

### **2.3 Legal basis**

All documents, actions, materials and service must be delivered or implemented with accordance to applicable laws, standards and regulations, obligatory for Poland and Georgia

- particularly in the scope of construction, electricity, servicing, safety, and technology.