Technical clauses

To provide hybrid solar systems as part of the "UKRAINE - Hybrid Solutions - 2023" project

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2024/01/02

SUMMARY

1. Purpose and general information

The Technical clauses informs the company as accurately as possible about the characteristics of the equipment required.

All supplies and deliveries will comply with this document produced by the project owner.

It is clearly understood that the Company is aware of the importance of the nature and difficulty of delivering the equipment and that it has made up for this using its professional knowledge, as well as the information it has obtained in advance. Consequently, in the event of error or omission, it cannot claim an increase in the overall price of its services.

Project details

In the midst of ongoing conflict, Ukraine faces critical challenges, particularly in ensuring the safety of its citizens. Public spaces, including schools and community gathering points, have designated shelters or invincibility points, serving as refuge areas in times of attack or emergency. These shelters should serve essential functions such as lighting, heating, and ventilation, which require a consistent power supply.

This document describes the technical requirements for the design and installation of several hybrid solar systems on Ukrainian shelters. In this tender, a hybrid solar system refers to an on-site, PV-based electrical system, interfaced with the main grid and local consumption. A hybrid solar system may also include energy storage and gensets (diesel engines) in its perimeter.

The addition of solar systems in these facilities is expected to:

- Provide a reliable electricity supply to the shelters, for up to 2 hours, even in the event of a network failure.
- Provide a more reliable supply of electricity to the public facilities under normal circumstances, with the added benefit of a greener energy production.

Contracting Authorities

The contracting authority: Electriciens sans frontières, a French NGO whose headquarter is located 5 Rue Jean Nicot 93691 PANTIN Cedex France, represented by Herve Gouyet as President.

The contracting authorities support (also named "partner association of Electricien sans frontieres"): will be the main point of contact for the contractor during the construction and will be responsible for the operational implementation, overseeing the dispatch, the conformity and the installation of the project:

- Charitable Organization "Charity Fund "Medical Aid Committee in Zakarpattya" (CAMZ), a charitable organization under the law of Ukraine "About charitable activities and charitable organizations", №5073-VI, whose registered office is located Koryatovicha square 2/10, Uzhhorod, 88000, Transcarpathian region, Ukraine.
  Contact address: camzua@gmail.com.

Or

Charitable Organization "Charity Foundation "Fortechnyi", a non-profit organization under the law of Ukraine, whose registered office is located at 89, Heroiv Mariupolia Street, Kropyvnytskyi, Kirovohrad Region, Ukraine.
Contact address: m.sydorov@astarta-group.com.

The contractor will direct all his questions to the contracting authority support and will send weekly reports as well as hold regular meetings with the representative of the contracting authority support. Every deviation from the contractual documents should first be validated by both the contracting authority and the contracting authority support of the relevant project.

Technical requirements

The technical requirements in this tender are split into:

- **R1 - Design requirements**: they ensure that the system sizing, equipment selection and control strategy is compliant with the goals identified by Electriciens sans Frontières for the given typology.
- **R2 - Equipment requirements**: they describe generic guidelines for the selection of equipment in the system. They are common to all typologies.
- **R3 - Acceptance requirements**: they specify the criteria that must be met to issue the project completion statement
- **R4 - Maintenance requirements**

2. System design requirements (R1)

Requirement	Description
R1.1 - System sizing	The system sizing for the PV system (PV field and battery) is the following (tolerance + 1/-0kW for the PV modules, +1kWh/-0 for the battery): - 20 kWc for the PV field - 2h of autonomy (considering the maximum Depth of Discharge allowed)
R1.2 - Genset integration	*Diesel generators will be procured on-site by the Contracting Party, but they shall be connected to the system by the Contractor.* The system has the required connectivity for a diesel generator, and allows for central coordination of: - the PV field - the battery - the diesel generator - the grid The system, namely its components and control architecture, is expected to follow these behaviors:

Requirement	Description
	When the grid is available - The diesel generator is OFF. - PV generation operates simultaneously with the grid. The inverter is synchronized with the grid frequency (grid following). - If the solar production exceeds the local load, the excess energy is stored in the batteries. - At the end of the day, the battery should be charged to a minimum SoC target (suggested 90% of the battery rated capacity). If solar energy was not sufficient to achieve this objective during the day, energy can be drawn from the grid until the target is reached. **In the event of a network outage** - The load is first powered by the panels and batteries through the inverter. - The diesel generator starts when the battery charge drops below a minimum threshold (suggested 50%). The diesel generator should be started automatically. - Under all circumstances, the battery is disconnected if the SoC level reaches the maximum Depth of Discharge (suggested 80%) - The central controller enables the parallel operation of solar panels and the backup diesel generator, preventing the risk of power reversal from the solar panels to the generators. **When the electricity network returns** - The load is switched back to the network. The diesel generator is stopped automatically and the inverter is synchronized again to the network. - The grid and the diesel generator should never operate simultaneously
R1.3 - Sheddable and non-sheddable loads	The system enables the separation of a priority network supplying the shelter from a load-shedding network supplying the rest of the building. In the event of a power outage, the system exclusively powers the priority network.
R1.4 - Zero reinjection	The system should be able to respect the zero-injection rule to the grid
R1.5 - Battery operation	The controller should - Forbid operation of the battery above a maximum Depth Of Discharge (suggested 80% for lithium LiFePo4 (LFP) batteries). The system should disconnect the battery when this situation occurs. - Minimize the Depth of Discharge throughout the year

Requirement	Description
	- Minimize cycling of the battery

The contractor must provide Electriciens sans frontières with the following documents (and any other relevant ones) to demonstrate that the envisaged system meets the requirements mentioned in section

Document	Description

D2.1.1 - System design	A technical document summarizing the system design proposal
	- Single line diagram of the system, displaying all the components
	- Complete electrical (1 or 3-phase) diagram of the installation, with clear identification of the priority and sheddable network.
	- Description and datasheets in English and Ukrainian whether possible for:
	  o PV modules
	  o PV controller(s)
	  o Battery
	  o Inverter
	- How the zero-injection rule is implemented
	- How the maximum depth of discharge rule is implemented

D2.1.2 - System manual	A hands-on manual of the installation for technicians including at least - System description - Safety precautions - Maintenance procedures - Troubleshooting guide - Basic repair and replacement guidelines - Contact information for assistance

3. Equipment requirements (R2)

The technical datasheet of all equipment in the system must be enclosed in the response.

i. PV modules

1. Equipment

- The composition of the modules can be either monocrystalline or polycrystalline. The proposal should consider both the efficiency and the cost-effectiveness ratio.
- The size of the generator will be calculated to ensure that the energy produced during the least favorable month is at least equal to the envisaged nominal load.
- The required power for each generator is a minimum nominal power calculated based on the individual module rated nominal powers. All modules at the same site will have identical technical specifications.
- The support structure frames are either anodized aluminum or galvanized steel. In the case of galvanized steel, the corrosion protection layer should be no less than 30 µm. The anti-corrosion warranty is a minimum of 10 years.
- The electrical production warranty for the modules must be 90% over a period of 10 years and 85% over 25 years.
- The photovoltaic modules are equipped with "hot spot" protection.
- Each module branch (or a set of branches if numerous) should have a device to electrically isolate it from the rest of the generator to facilitate maintenance or fault detection.
- In the case of multiple panels being associated, the peak power tolerance between each panel should not exceed 3%.
- The dimensions and weight of the panels will be provided.
- The datasheet for the panels will be supplied.

PV modules must be certified in accordance with various international standards, particularly:

- IEC-61215: Qualification for the design and approval of crystalline silicon PV modules.
- IEC 61730-1 and 2: Qualification for the safety of operation of PV modules or the national standards used in the country of operation.
- The battery system voltage (12, 24, or 48 volts to be confirmed) is tailored to the power consumption to reduce line losses.
- The nominal generator power is calculated, taking into account the efficiency of various devices and losses related to connection cabling.

2. Installation

<u>Mechanical Aspects</u>

- **Orientation**: The contractor will arrange the modules to ensure optimal sunlight exposure (free from any shading) and commit to the generator's performance when so positioned.
- **Tilt**: The tilt relative to the horizontal will be selected for the photovoltaic array in the design phase, and this tilt will be fixed during assembly.

- **Location and Fastening:** The installer will ensure that the generator is positioned in a way that no shadows are cast on the modules by surrounding vegetation or various obstacles such as parapets. An open space beneath the modules will facilitate natural ventilation.

Electrical Aspects

Modules:

- They will be of the same origin (brand, power, etc.).
- The modules will be interconnected as per the electrical diagram provided in the appendix to form one or more branches, with the total voltage equal to the nominal service voltage, while keeping interconnection cable lengths to a minimum.
- The installer will make sure that the formed branches consist of modules with as uniform nominal unit power as possible (module pairing).
- The cable outputs of the branches will be on the "lower" part of the junction box, with the upper cable gland of the "high" junction box (the one more exposed to the elements) sealed.

Connection and Junction Boxes:

- The module branches will be individually connected to junction boxes, which parallel-connect these branches. Separation between the branches will be ensured by a diode in series on each branch if not already integrated into the modules.
- The installer will ensure that the mounting and wiring of all boxes do not compromise their watertightness. In all cases, cable entry should be sealed with cable glands ensuring the boxes' waterproofing with "drip loop" wiring. Galvanized steel cable trays will gather the connections and directly route them to the conduit(s) leading to the technical room.
- Ideally, the junction boxes will be installed vertically under the solar array, or under cover in other cases.

Grounding of Structures and Connections: see Grounding of the installation

ii. Support structures

1. Equipement

- The materials of the support structures are designed to withstand a minimum of 10 years of exposure to the external climatic conditions of the site without showing signs of corrosion or premature fatigue.
- The support structures are engineered to withstand winds of 120 km/h.
- The selected tilt angle of the support structure is a compromise between months of high and low insolation to optimize energy capture during the least favorable months, taking into account a constant usage load.
- Mobile support structures are not allowed.

2. Installation

- Fixing the PV modules within metal frames onto the support structure is done exclusively using tamper-proof fasteners made of a metal compatible with the support to avoid electrolytic coupling (stainless steel, aluminum, etc.). To prevent electrolytic coupling, insulating washers (Teflon, etc.) are included in the supply.
- The assembly of the support structure is designed in such a way that access to the modules is facilitated for maintenance and inspection of junction boxes.

iii. Batteries

1. Equipment

- The battery model must be lithium LiFePo4 (LFP).
- Unless specified otherwise, the depth of discharge (DoD) for the battery is set at 80% of the nominal battery capacity for LFP. Since daily DoD affects the battery's lifespan, the goal is to find the best compromise between DoD (to be minimized as much as possible) and capacity (which defines the cost) to be installed based on the project's requirements.
- A battery charge level controller will be installed with disconnection in case of discharge > 80%
- The usable capacity of the battery (the product of its nominal capacity and the allowed depth of discharge) must provide system autonomy according to the requirements.
- The monthly self-discharge rate of a new battery at 25°C should not exceed 3% of the nominal capacity and 6% at a temperature of 33°C.
- Battery capacity is primarily given for an ambient temperature of 25°C and decreases at lower temperatures. The battery shall be selected so that the temperature coefficient for the capacity of the battery is:
    - Above 90% at 10°C
    - Above 80% at 0°C
    - Above 70% at -10°C
- For LFP batteries, it is recommended to use batteries that can provide 5,000 cycles at 50% DOD and 2,500 cycles at 80% DOD at 25°C.

2. Installation

- If possible, the installer should provide thermal regulation to maintain the battery's lifespan. This regulation can be achieved by installing the accumulators a few centimeters above the ground. Its charge/discharge level will be controlled by equipment like a BMV from Victron.
- The batteries will be installed on an insulating support (synthetic material or treated wood).
- The terminal posts of the batteries and connections between the elements will be electrically insulated.
- The battery will have an external marking indicating the battery type, its voltage, its capacity in C10, and the date of first commissioning. Battery elements will be labeled with numbers on supports.

Commissioning :

A battery formatting charge will be carried out using the photovoltaic field or a battery charger until the density and voltage of each element reach the respective values recommended by the manufacturer.

iv. PV Controller

1. Equipment

- The PV controller will be located indoors, or alternatively, in a watertight electrical cabinet with a minimum IP32 protection rating for the equipment.
- The PV controller will be of the MPPT type.

- The PV controller must be capable of managing various charge regimes, including bulk, absorption, and floating. The values for these regimes will be provided by the manufacturer based on the battery type used.
- The PV controller should have temperature compensation capabilities, either through an internal sensor or the option to connect an external sensor to measure battery temperature if the batteries are located far from the regulator.
- The PV controller should be protected against induced overvoltages on both the input terminals from the PV generator and the output terminals for the load.
- The PV controller's terminals should be designed to accept cables with a minimum cross-section of 4mm².
- The PV controller should be able to operate without damage under the following conditions:
    - An ambient temperature of 45°C
    - A charge current 25% higher than the short-circuit current of the PV generator under standard test conditions
    - A discharge current 25% higher than the full load current at the nominal operating voltage.
- The electrical consumption of the regulator under normal operation, with the PV generator and load circuit operational, should not exceed 15mA.
- The PV controller should be equipped with a manual device for forced battery charging, with the usage parameters (voltage threshold, charging time) specified by the manufacturer.
- The charge cutoff voltages should correspond to the values of the maximum discharge depth that may be displayed.
- The voltage thresholds for charge cutoff, reconnection, and charge cutoff warning should have an accuracy of ±1% (±20mV per cell) and remain constant within the defined ambient temperature range.
- The PV controller should include protection against any reverse polarity in the PV generator or battery circuit.
- The minimum cable section allowed on the regulator's terminals should be at least 4mm².

2. Installation

A visual charge indicator should ensure monitoring the battery's state of charge and the load.

- The controller must be protected against:
    - Reverse polarity
    - Surges or voltage spikes.
- In general, the installation will adhere to the recommendations provided by the manufacturer regarding electrical and mechanical aspects

v. Inverter

1. Equipement

- The proposed equipment is designed for a minimum lifespan of 10 years under the normal operating conditions of the installation site.
- The inverter has the same number of phases as the target installation (single-phase inverter for single phase installations, 3-phase inverter for 3-phase installations), and its AC output is compatible for operation in the Earthing System of the installation.

- The proposed inverter technology is compliant with MPPT control.
- The input voltage is equivalent to the battery or controller voltage.
- The inverter (or an equivalent external device) disconnects consumers at 50% of the charge and reconnects them at 80% charge.
- Unless otherwise indicated, the output signal is sinusoidal with a frequency of 50 Hz and a voltage of 230 Volts (between the phase and neutral).
- The device is designed to operate at the rated power required for the indicated load, with information on the permissible overload (variable according to the manufacturers) and the power loss due to high temperatures.
- The efficiency of the device will be greater than or equal to 95%.
- The choice of equipment will take into account the derating applicable based on the ambient temperature in which it is intended to operate (for example, the local temperature +10°C compared to the outside temperature).
- The installation of surge protection against atmospheric surges will be provided.

2. Installation

- The inverter must be protected against short circuits and overloads. In case of overcurrent, there should be no destruction, even partial, of the inverter other than consumables (fuses).

Note: Particular attention should be paid to the choice of downstream protections for inverters (magnetic thermal tripping curves, UR fuse). The current short-circuit value on this type of installation is limited.

vi. Wiring

To prevent voltage drops that could affect the proper operation of the installation, characterized by low voltages and high currents, special attention must be given to the wiring. As a general rule, the arrangement of the equipment should favor electrical connections that are as short as possible. Electrical connections will adhere to the standardized color code, where in direct current (DC), the blue wire represents the negative polarity, and the red wire represents the positive polarity. In alternating current (AC), the phases are indicated by the red, brown, and black wires, the neutral by the blue wire, and the ground by the green-yellow wire.

1. Equipement

- Exterior cables are selected to withstand weather conditions, including protection against UV radiation, and meet the international standard IEC 60811 or the equivalent standard of the respective country.
- Cables are either color-coded or labeled for identification.
- Cable sizes are chosen to result in voltage drops lower than:
    - 2% of the nominal PV voltage between the junction box and the controller.
    - 1% of the battery voltage (at the regulator's Imax) between the controller and the battery.
    - 1% between the battery (at the Imax requested by the inverter) and the inverter.
    - 3% for AC lines at the consumer's nominal current (Inom).

2. Installation

- All cables, mechanisms, electrical fixings, and assemblies will be installed and connected in accordance with IEC, and other appropriate electrical standards.
- The primary objective is to minimize risks to individuals and animals, as well as damage that may occur to the connected electrical system during operation and maintenance, under all specific environmental conditions of the site.
- Whenever there is a probability of disconnection or cable damage, reinforced cables or conduits will be used. Special attention will be paid to the choice of conduits (ducts), ensuring they can withstand UV exposure and temperature variations.
- Electrical connections will be made in a manner that prevents any risk of false contact or disconnection due to, for example, cable tension.
- For indoor distributions: The routing of electrical cables, as well as their fixation and other elements such as junction boxes, will be designed to seamlessly integrate with the relevant buildings while seeking to reduce cable lengths.
- All internal cables will be concealed within the most discreet cable trays, unless otherwise specified by the beneficiary.
- Cable Identification: All cables in the main distribution panel (power, control, and measurement) will be equipped with identification tags at each end. Junction box-to-panel connections will also be fitted with identification tags.

vii. Monitoring

To facilitate the performance monitoring of installations and potentially engage in preventive maintenance and troubleshooting with the assistance of a local company, Electriciens sans frontieres aims to promote and encourage remote monitoring solutions. The implementation of such a system, with remote diagnostics for proper operation, contributes to the sustainability of the installation for a real and lasting impact.

1. Equipement

- Given that manufacturers of PV installations often offer monitoring solutions with proprietary communication methods, the use of equipment from different manufacturers in the same installation is prohibited, unless compatibility can be demonstrated (a technical datasheet must be provided).
- The monitoring system should be able to consolidate all available and timestamped data from an installation, including:
    - Voltage: PV panels, battery, 230V grid
    - Current: PV panels, battery, 230V grid
    - Delivered or consumed power, battery charge
    - Temperature
    - Grid and Generator operation
    - Alarms from devices (regulator, battery, inverter, etc.)
    - Various sensors (e.g., solar radiation sensor, water installation level sensor)
- Specify the internet connection to be provided (if available): e.g., a 4G modem.
- The monitoring device, a real control panel for the installation, should be able to save this time stamped data and transfer it to an internet server. This will provide a historical record of production and consumption data.

- Preference should be given to equipment that provides access to the manufacturer's web portal, usually for free, and offers ease of visualization (e.g., graphs) and use of time stamped data.
- In addition to remote diagnostics of the system's proper operation provided by the device connected to the manufacturer's web portal, it should allow remote access by the installer initially, and by Electriciens sans frontieres after the warranty period, to adjust certain threshold parameters (alarms or others). It should also allow remote software updates for the installation's devices.

2. Installation

The installation of the monitoring system will adhere to the manufacturer's recommended specifications. Special attention will be given to using the recommended communication cables and making any necessary line adaptations.

viii. Protections

The installation of equipment and devices will be carried out in compliance with the local norms and regulations. Particular attention will be given to protection in the following areas:

- User and maintenance personnel protection when working on the generator (electrocution risks), safeguarding against user error or malfunctions that could lead to equipment damage (short circuits, polarity reversal, various origin overvoltages, etc.).
- Protection of buildings against fire hazards resulting from the malfunction of the installation.

All components implemented by the company must, therefore, be protected in accordance with the descriptions below.

Protection Against Direct Contacts

Protection against direct contacts must be ensured. Preventive measures are intended to keep live parts out of reach by:

- Isolation of live parts: insulating enclosures of equipment, external insulation of conductors.
- Use of barriers or enclosures: cabinets or enclosures with a minimum IP2x or IpxxB protection rating.
- Distance or out-of-reach installations: partial protections primarily used in electrical service rooms.

Protection Against Indirect Contacts

Use of Class II: for installations (or parts of installations) involving only a few fixed use devices without power outlets, protection against indirect contacts can be ensured if the entire installation complies with Class II requirements (conduits, devices, usage appliances, etc.) either through construction or through additional insulation during installation.

The installation must be compatible with the local Earthing System, to ensure personal safety. Attention is drawn to the fact that several Earthing Systems co-exist in Ukraine.

Protection Against Overcurrents

All parts of the system must be protected against overcurrent according to the local norms. In DC circuits, overcurrent protection must be provided for both polarities, and the characteristics of the circuit breakers must be adapted for DC. It is also required to provide protection against short circuits for all battery connections (power and measurement).

Switching

<u>DC current</u>

- General switching at the energy management panel.
- This interruption must be possible under load (load disconnect switch). A single control must be operated to enable these disconnections. This control must be accessible.

Source Protections

- Bipolar protection (by fuse) for the battery must be possible in all cases, allowing complete isolation of the battery. This protection must be possible on all connections from the battery (power and measurement).
- Other requested switching:
    - At the solar field input.
    - Upstream of the inverter for distribution departure.

230V AC current

A bipolar switch is required for the 230V output from the inverter to distribution.

Isolation of Elements: Wherever possible, circuit breakers will be placed upstream and downstream of each piece of equipment to facilitate maintenance operations

Electrical distribution to consumers will be via an electrical panel, which will include, upstream, a differential switch (30 mA), followed by circuit breakers whose sizes are determined based on the connected consumers.

Protection Against Atmospheric Origin Surges.

During a lightning strike, the electrical discharge generates surges, electrodynamic forces, thermal effects, and induction effects. These can lead to electrocution, fires, and the destruction of technical installations.

To guard against the risk of atmospheric origin surges, the following measures will be implemented:

- Earthing of the solar field support structures via a ground connection. This grounding will be done using insulated yellow-green or bare copper with a section of at least 6 mm².
- Protection by direct current surge arresters at the output of the modules between both polarities and the ground, for each connection between the photovoltaic field and the control panel.
- Installation of an additional surge arrester (SA) on each cable at the regulation input (one SA between + and -, one SA between + and ground, one SA between - and ground).

ix. Grounding of the installation

For each component system within a PV system, grounding will be established according to the following procedures.

A bare copper ground rod with a cross-sectional area of 25mm², in a trench and with ground rods, will be installed. All components of the installation (including solar panel arrays) will be connected to it, limiting the areas of induced loops. The cross-sectional areas will be in line with the active conductors (typically 6 mm²). A ground cable will be connected to a terminal at the distribution panel locations.

In the case of multi-building distribution, a ground rod (+ ground bar) is planned for the primary distribution board (usually located in the technical room) and ground distribution via a 25 mm² ground cable in a trench to each secondary electrical distribution panel.

4. Acceptance requirements (R3)

Requirement	Description
R3.1 - System description	All required documents have been provided to the contracting authority **To provide:** - Detailed electrical diagram of the installation - Detailed wiring for each equipment - Configuration parameters - Technical datasheets, user manuals, maintenance and operation manuals for all the equipment/material installed - All the documents required in the design requirements section (D2.1.1) - Photographs of each equipment in the installation, with detailed pictures on wiring and connections
R3.2 - Acceptance test under standard conditions	A planned acceptance test covering at least 2 working days has been conducted by the contractor. During this test, - No Depth Of Discharge greater than the maximum DoD was observed - No disconnexion of the storage was observed - No power was injected to the main grid **To provide**: The contractor is responsible for providing any documentation or evidence verifying that the stated criteria are met
R3.3 - Acceptance test during network outage	A planned or unplanned acceptance test covering at least 24 hours, in which a grid disconnexion of at least 1 hour occurs should be reported. During the grid disconnexion, the following must be observed: - Load-shedding of the non-priority network - Electricity supply to the priority network - DoD of the battery below the maximum level during all the test period (or disconnection of the battery if maximum DoD reached during the test) - no failure at grid disconnection and reconnection **To provide**: The contractor is responsible for providing any documentation or evidence verifying that the stated criteria are met
R3.4 - Availability of monitoring data	Monitoring data is available during the acceptance test(s). **To provide**: A csv extract of monitoring data + system logs

5. Maintenance requirements (R4)

Requirement	Description
R4.1 - Monitoring	Data produced by the monitoring system is stored on servers for at least 2 years. The contracting party can access this data at all times, either upon request to the contractor, or through a secure remote access granted to the contracting party.
R.1.4.2 - 1st year warranty	The contractor undertakes to provide a warranty of at least one year, starting from the issuance of the completion statement. **Critical Issues:** Critical issues are defined as those significantly affecting the functionality or safety of the solar plant. These include but are not limited to core system malfunctions, critical component failure, or safety hazards. For critical issues, the contractor shall guarantee an immediate response, with repairs or **corrective actions initiated within 5 days** from the notification of the problem. **Non-critical issues** Non-critical issues are defined as those that do not compromise the core functionality or safety of the system but impact its efficiency or performance. For non-critical issues, the contractor shall respond within a reasonable timeframe, not exceeding **2 weeks** from the notification of the problem. **Notification Process**: Any issues observed during the warranty period should be promptly reported to the contractor in writing, specifying the nature of the issue, its observed impact, and its classification as critical or non-critical. The notification shall trigger the timeline for the respective response and resolution based on the issue's criticality. *The contractor may include a quote for yearly O&M services after the first year, with a detailed description of the preventive and curative maintenance services included in the offer.*

Appendix : Input data

Ref	Partner	Region, Community	Locality	GPS	Object	Name	Genset on site	Photos
RFP 1 Site 1	Fdt Fortcheniy	Chernihiv, Ripkinska	Ripky	Ripky school №2 I-IIIst. im. Billy Herringtona	Lyceum	Heating of the bomb shelter	5kVA	photo_2023-10-24_11-50-20 (1).pdf
RFP 1 Site 2	Fdt Fortcheniy	Chernihiv, Chernihiv	Chernihiv	Mens'ka Himnaziya	School	Chernihiv Lyceum No. 22 of the Chernihiv City Council	13 kVA	photo_2023-11-09_16-37-50 (2).pdf
RFP 1 Site 3	Fdt Fortcheniy	Chernihiv, Chernihiv	Nizhyn city	ЗОШ №15	School	Nizhyn Secondary School of Grades I-III No. 15, Nizhyn City Council	9kVA	photo_2023-11-08_11-54-19 (2).pdf
RFP 1 Site 4	Fdt Fortcheniy	Chernihiv, Chernihiv	Kulykivka TC	51° 22' 22.8216" N 31° 38' 36.7872" E	School	Kulykivka Lyceum of the Kulykivka Settlement Council of the Chernihiv District of the Chernihiv Region	3,5 kVA	photo_2023-11-09_11-03-19 (2).pdf
RFP 1 Site 5	Fdt Fortcheniy	Chernihiv, Chernihiv	Mena city	Mens'ka Himnaziya	school	The main institution is the Mena Gymnasium n°7 of the Mena City Council	3kVA, 2 PCS 7kVA, 1 PCS	зображення_viber_2023-11-09_14-25-49-123.pdf
RFP 1 Site 6	CAMZ	Rivne, Klevanska settlement territorial community	Klevan	50.74564978710288, 26.02744813819929	School	Klevanska special boarding school №1		

Ref	Partner	Region, Community	Locality	GPS	Object	Name	Genset on site	Photos
RFP 1 Site 7	CAMZ	Rivne, Klevanska settlement territorial community	Klevan	50.74748635702819, 26.035750484657708	School	Klevanska special boarding school №2		
RFP 1 Site 8	CAMZ	Rivne, Bereznivska city territorial community	Berezne	Berezne, 4 Rivnenska str. https://erudit.org.ua/contacts	School	NGO "CHILDREN'S DEVELOPMENT CENTER "ERUDIT"	3kVA	
RFP 1 Site 9	CAMZ	Rivne, Bereznivska city territorial community	Holubne	50.892412338502474, 26.69060839712105	Lyceum	Holubnivskyi Lyceum of the Bereznovskyi City Council	6kVA	
RFP 1 Site 10	Fdt Fortcheniy	Chernihiv, Chernihiv	Chernihiv	Chernihivs'ka Zahal'noosvitnya Shkola-Internat I-Iii	school	Chernihiv general Boarding School	three-phase group, starts manual There may be 2 gensets on site (16kVA and 18kVA) + battery. to be	photo_2023-11-09_14-16-10.pdf

Ref	Partner	Region, Community	Locality	GPS	Object	Name	Genset on site	Photos
							confirmed	
RFP 1 Site 11	Fdt Fortcheniy	Chernihiv, Chernihiv	Bakhmach TC	Vul. Yaroslava Mudroho, 4	School	Bakhmach Lyceum No. 1 Bakhmach City Council	2,5 kVA just for the lightning three-phase group, starts manual	photo_2023-11-08_14-42-51 (2).pdf
RFP 1 Site 12	Fdt Fortcheniy	Chernihiv, Chernihiv	Pryluky city	50° 35' 34.512" N 32° 23' 29.8968" E	School	Pryluky gymnasium No. 1 named after Heorhy Voronyi of the Pryluky of the city council of Chernihiv region	5 kVA three-phase group, starts manual	photo_2023-11-07_12-22-47 (2).pdf
RFP 1 Site 13	Fdt Fortcheniy	Chernihiv, Chernihiv	Pryluky city	Kyivska St, 375 50°.591099,N 32°.412979	School	Pryluky gymnasium No. 10	6.5 kVA three-phase group, starts manual	photo_2023-11-07_13-54-03 (2).pdf

Ref	Partner	Region, Community	Locality	GPS	Object	Name	Genset on site	Photos
RFP 1 Site 14	Fdt Fortcheniy	Chernihiv, Chernihiv	Varva TC	50° 29' 43.5624" N 32° 43' 31.17" E	School	Communal institution of general secondary education of I-III degrees "Varva Lyceum No. 1"	32 kVA (not used at the moment) three-phase group, starts manual	photo_2023-11-07_17-10-04.pdf
RFP 1 Site 15	Fdt Fortcheniy	Chernihiv, Chernihiv	Korop TC	16201 51°.564960,32°.954958	School	Korops comprehensive school of grades I-III named after T.H. Shevchenko of the Korop settlement council of the Chernihiv region	three-phase group, starts manual. The generator of 5.5 and 6.5 kVA is in stock. The battery of 15 kVA is installed.	photo_2023-11-08_16-21-01 (2).pdf
RFP 1 Site 16 (one project for 2	Fdt Fortcheniy	Kharkivskyi , Kharkiv	Tsyrkuny	Soborna St, 26	School	New school of Tsykourny	12kVA three-phase group, starts manual	

Ref	Partner	Region, Community	Locality	GPS	Object	Name	Genset on site	Photos
buildi ngs)	Fdt Fortcheniy	Kharkivskyi , Kharkiv	Tsyrkuny	Soborna St, 26	Outpatie nt clinic, village council	Solar panels, battery	60 kVA	photo_2023-11-15_14-32-14.pdfs