# *ANNEX II + III:* TECHNICAL SPECIFICATIONS + TECHNICAL OFFER

**Contract title: Procurement and installation of solar energy plant for project “Greening the cities – Development and promotion of energy efficiency and sustainable urban environment in the cities of Croatia-Serbia cross-border region” p 1 /11**

**Publication reference:** HR-RS290 – IPA PP3 – TD04

**Columns 1-2 should be completed by the contracting authority**

**Columns 3-4 should be completed by the tenderer**

**Column 5 is reserved for the evaluation committee**

Annex III - the contractor's technical offer

The tenderers are requested to complete the template on the next pages:

* Column 2 is completed by the contracting authority shows the required specifications (not to be modified by the tenderer),
* Column 3 is to be filled in by the tenderer and must detail what is offered (for example the words ‘compliant’ or ‘yes’ are not sufficient)
* Column 4 allows the tenderer to make comments on its proposed supply and to make eventual references to the documentation

The eventual documentation supplied should clearly indicate (highlight, mark) the models offered and the options included, if any, so that the evaluators can see the exact configuration. Offers that do not permit to identify precisely the models and the specifications may be rejected by the evaluation committee.

The offer must be clear enough to allow the evaluators to make an easy comparison between the requested specifications and the offeredspecifications.

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | **4.**  **Notes, remarks,  ref to documentation** | **5.**  **Evaluation committee’s notes** |
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| **N/a** | **LOW VOLTAGE ELECTRICAL INSTALLATIONS**  1. All works on the designed electrical installations of LV must be carried out in accordance with the Rulebook on Technical Standards for Low Voltage Electrical Installations (Official Gazette of the SFRY No. 53/88).  2. Electrical equipment and distribution must correspond to the designed parameters and the performed classification of external influences, and during normal operation and in transient modes, it must not have a harmful effect on other equipment.  3. Equipment of the same type of current and/ or voltage shall be grouped and placed in the switchgear blocks and must be separated from the electrical equipment of another type of current and/or voltage, so that no harmful influences can occur. Schemes of electrical installations of LV with clear characteristics of the elements of individual circuits and markings that must be harmonised with the markings of the installed equipment are placed in the switchgear blocks.  4. Insulated conductors and cables must be laid or marked in such a way that they can be easily identified, when tested, repaired or replaced. The conductors are made of copper with insulation colour in accordance with the valid SRPS standard. The protective conductor (PE) and the protective - neutral conductor (PEN) are marked in yellow - green, the neutral conductor (N) in light blue. These colours must not be used for any other marking.  5. Insulated conductors and cables of electrical distribution must be protected from mechanical, chemical and thermal damage, by the appropriate type of distribution (SRPS. IEC 60364 - 5 - 52), method of installation, position and coating. In particularly vulnerable places (for example, routing cables in the floor), additional protection measures must be applied by installing protective pipes, ducts, etc.  6. The cross-section of insulated conductors in friction electrical installations must not be less than 1.5 mm2 for copper conductors, or 2.5 mm2 for aluminium conductors. This requirement does not apply to insulated conductors in switchgear blocks and electrical appliances, lamps etc.  7. In multiphase current circuits in which the cross section of phase conductors made of copper is greater than 16mm2, or greater than 25mm2 for aluminium conductors, the neutral conductor may have a smaller cross section only if the conditions from Art. 18 RTS.  8. Insulated conductors and cables are connected in installation boxes, cable connectors or switchgear blocks. The joints must be secured and stable and made so that there is a possibility of verification. Insulated conductors and cables must not be laid in the installation pipes and ducts.  9. Permanent sealing (for example with strain relief connectors) must be performed at the ends of electrical distribution, exits, entrances and points of penetration through walls and electrical equipment.  10. If there are other electrical installations in the vicinity of the electrical distribution, such a distance must be provided between them that the maintenance of one installation does not endanger other installations, at least 30 mm.  11. Electrical distribution is not placed under non-electrical installations where condensation of water or other liquids is possible. If the electrical distribution is installed on the walls, the minimum distance from the wall is 5mm.  12. Conductors of only one circuit may be placed in the same installation pipe or duct, except for conductors of control and auxiliary circuits. More circuits must not be routed through the same multicore cable, except for the conductors of the control and auxiliary auxiliary circuits. | | | |

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| **N/a** | 13. Cables laid directly in the mortar and the wall must be covered with mortar at least 4 mm thick along their entire length. This does not apply to cables laid in wall cavities made of a material that does not burn or stimulate burning.  14. Cables and installation conductors in pipes in the wall, run vertically and/or horizontally, parallel to the edges of the room. The distance from the edges of the window and door must be at least 15cm. Oblique laying is allowed in the ceilings, but not in the walls. Conditions for laying cables in rooms with bath and shower are determined by the standard SRPS IEC 60364 - 7 - 701.  15. Cables with thermoplastic insulation, filling and sheath can be laid on the wall on clamps and if they are from the floor to a height of 2 m, protected from mechanical damage. Wall-mounted installation accessories must have sealing glands and a degree of protection of at least IP5X for damp rooms, or an appropriate degree of protection determined for other rooms.  16. Unfilled cables, such as PP/R, may only be laid in dry rooms, under mortar or in cavities in ceilings and walls made of non-combustible material. These cables must not be routed in a bundle or through installation ducts and must not be laid on flammable materials even when covered with mortar.  17. When laying cables, care must be taken not to damage the sheath, the minimum allowable bending diameter (up to 15 D), as well as the ambient temperature, which for cables with PVC insulation should be above + 50C.  18. Switchgear blocks in electrical installations must be designed and constructed in such a way as to satisfy the protection measures, in particular as regards the protection against direct and indirect contact, protection against overvoltage and fire. Air gaps in switchgear blocks must be:  - between uninsulated parts under voltage of different poles at least 10 mm;  - between uninsulated live parts and other conductive parts and casing at least 20mm.  19. The conductors for the components of the electrical equipment on the doors or covers of the distribution blocks must be flexible.  20. On the outside of the switchgear blocks, there must be a plate with the name of the manufacturer, the designation of the power supply system in terms of grounding and other information about the equipment that is powered from it. All elements must be clearly marked with permanent markings in accordance with the technical documentation and schemes enclosed with the switchgear block.  21. The protective PE conductor must not be disassembled or interrupted in any power supply system. In the TN - C system, the protective - neutral conductor (PEN) must not be disassembled or interrupted. In the TN - S system, the neutral conductor (N) does not have to be disassembled or interrupted.  22. Every electrical installation during construction and/or when it is completed must be inspected and tested in accordance with the provisions of the Rulebook on Technical Standards for Electrical Installations of LV and Applicable Standards. Examination and testing may be performed by an institution approved by the competent ministry. A report is made on the performed inspection and testing with a clear conclusion on the evaluation of the installation. | | | |

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| **N/a** | **LIGHTNING ROD INSTALLATION**  1. Works on the construction of the designed lightning protection installation must be performed in accordance with the given solutions, general conditions for construction from this design, as well as the provisions in SRPS IEC 1024 - 1.  2. For the receiving system of the lightning rod installation (clamp), metal sheets, metal elements of the roof construction, metal parts such as gutters and other metal parts that meet the requirements of the standard can be used as a "natural" receiving system.  3. Sheet metal roofing the thickness of which is not less than 0.5 mm, can be used as a "natural" receiving system, if its protection from damage by atmospheric discharge current is not important and if there is no danger of burning of materials under the sheet.  Thin layers of protection in the form of paint or 0.5mm asphalt or 1mm PVC are not considered insulation.  4. Metal pipes or metal tanks with a wall thickness of at least 2.5 mm may be used for the receiving system, if their penetration by the current of atmospheric discharge does not lead to a dangerous situation.  5. The down conductors must be so arranged as to represent, as far as possible, a direct extension of the conductors of the receiving system.  6. Down conductors are arranged according to the volume of protected space so that the average distance between them is not more than: 10m for 1st level of protection, 15m for 2nd level of protection, 20m for 3rd level of protection and 25m for 4th level of protection.  7. The down conductors must be laid in a straight line or vertically following the shortest and most direct route to earth. In all cases, at least two down conductors are required.  8. "Natural components" such as the metal skeleton of the building, connected steel fittings of the building and facade elements may be used for the down conductors if their thickness is not less than 0.5 mm.  9. A test connection must be installed at the junction of each down conductor (except in the case of a natural down conductor) with grounding, which can be disassembled using a tool for measuring purposes.  10. Specially laid lines, reinforcement of concrete foundations of a building or their combination can be used as a grounding conductor. Grounding conductors as specially laid conductors can be made in the form of one or more ring grounding conductors, as vertical grounding conductors, radial grounding conductors or foundation grounding conductors.  11. Burial depths and types of grounding devices must be such as to minimise the effects of corrosion, freezing and drying of the soil and to achieve the value of equivalent resistance that must be achieved in accordance with SRPS IEC 1024 - 1.  12. The receiving system and the down conductors must be firmly connected by welding, clamping, screw clamping or riveting.  13. Copper with a minimum cross-section of 35 mm2 or galvanised steel with a minimum cross-section of 80 mm2 - round or 100 mm2 in the form of a strip can be used for the grounding system.  14. Lightning rod protection installation is subject to inspection and verification that can be performed  by an authorised work organisation in accordance with the provisions of SRPS IEC 1024 - 1. | | | |

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| **1** | **SOLAR FIELD**  **Quantity: 1 System (387 pieces, )**  **Minimal technical requirement:**  Photovoltaic panels with maximum operating voltage Ump = 36.70V and current Imp = 8.64A are installed on the appropriate structure on the existing ground structure.  The basic characteristics of the facility for the generation of electricity are:  Type of photovoltaic panels 310W monocrystal  Installed power 120kWp  Number of inverters 6  mains inverter type 20 kw UE  - Solar cell type: Monocrystalline silicon cell  - Number of cells on the panel: 156x156mm 60 (6x10)  - Panel dimension: 1650x992x38mm  - Panel weight: 18.5 kg  - Panel glass: Safe tempered glass 3.2 mm thick  - Panel frame: Anodised aluminium  - Energy tolerance: +/- 3%  - Ambient temperature: from -400C to + 850C  - Connection cable length: 800mm  - Guaranteed efficiency: 90% for 10 years / 80% for 25 years  - Warranty: 10 years  - The substructure will be made of steel profiles, anchored with concrete anchors without damaging the roof covering in a lightweight construction. |  |  |  |
|  | **PHOTOVOLTAIC MODULES**  The basic component of any photovoltaic system is a photovoltaic panel. Each panel consists of a large number of photovoltaic cells that are connected both in series and in parallel to obtain appropriate voltage or power. Their basic characteristics include a long period of exploitation, a high degree of efficiency, as well as high resistance to mechanical and atmospheric effects. The most important factor that affects the electricity generation of each module is its power. The power of each panel increases with decreasing the temperature and vice versa, it decreases with increasing temperature.  **Minimal technical requirement:**  panels have the following minimal characteristics at a radiation of 1000W / m2, spectral distribution AM 1.5, temperature 250C (in accordance with EN 60904 - 3): Maximum power Pmax 310 Wp  Maximum operating voltage Vmp 36.70 V  Maximum operating current Imp 8.64 A  Idle voltage VOC 35.60 V  Temperature coefficient at Pmax -0.45% / 0C  Temperature coefficient on VOC -0.34% / 0C  Temperature coefficient on Isc 0.05% / 0C  **ROOF MOUNTING**  Quantity: 1 System (387 pieces, )  - Aluminium structure |  |  |  |
| **2** | **INVERTER**  **Quantity: 6 units**  **Minimal technical requirement:**  - Maximum peak power: 5kW  - Maximum DC voltage: 1000 V  - Maximum output power: 5kW  - Output voltage range: AC 220V  - Maximum efficiency: 98%  - Output frequency range: 50Hz / 60Hz  - Current distortion: THD 3%  - cos: φ 0.8  - Protection degree: IP45 |  |  |  |
| **3** | **DISTRIBUTION CABINET WITH FUSES**  **Quantity: 2 units**  **Minimal technical requirement:**  - The distribution cabinet contains equipment for protection, monitoring and management of SFS elements from the input for connecting the strings of solar panels to the output from inverters that supplies alternating voltage. |  |  |  |
| **4** | **CABLES 1x600m2**  **Quantity: 400 pieces**  **Minimal technical requirement:**  **CABLE DIMENSIONING**  The choice of cable lines cross-section was made based on permanently allowed currents in accordance with applicable standards. The temperature of the environment in which the cables are laid corresponds to those temperatures for which the standard prescribes permanently allowed currents (for cables laid in the ground 200C, and for cables laid in the air 300C), so that the temperature correction factor kt = 1 has been adopted. |  |  |  |
|  | For power cables, it is considered that they are laid in a trench or in a cable sewer buried in a trench in the "dry earth" soil category the thermal resistance of which does not exceed 1mK / W, and as a result, correction factor for thermal resistance of soil kλ = 1.18 (SRPS IEC 60364 - 5 - 52) has been adopted. For the case of parallel routing of several cables, the standard prescribes correction factors for group circuits, in case all cables would be simultaneously loaded with permanently allowed currents and long enough to reach the steady state temperature.  In this specific case, one multi-core cable is laid for the supply of the irrigation pump located outside the facility in question, so the factor of group laying is adopted and amounts to kn = 1.  **CABLE DISTRIBUTION**  Cable distribution and connection equipment is also provided by the supplier, who also performs installation, connection and commissioning work. The interconnection of individual PV solar panels is done with "S - Flex01" conductors with a cross section of 4 mm2. The strings of PV solar panels are connected to the GRO by "S-Flex01" conductors with a cross-section of 4 mm2. Photovoltaic panels that are exposed to various atmospheric influences, rain, snow, solar radiation and high temperatures, are interconnected with a "S - Flex01" conductor - a special conductor for this purpose. These high-quality cables are equipped with connectors specially designed and made for solar panels.  The materials from which the cables and connectors are made can withstand even the most extreme atmospheric and mechanical influences and work reliably and safely for several decades. |  |  |  |
|  | According to IEC 216, "S - Flex01" solar cables have 8 times longer lifespan than rubber insulated cables and up to 32 times longer lifespan than PVC insulated cables. The wiring of the solar panels is conducted with pre-measured cables with built-in connectors, so that the wiring itself is very fast and without the use of additional tools. The cables are made in red and black, so that a visual inspection of the wiring can be performed.  The manufacturers recommend the use of a 4mm2 S-Flex01 cable for the connection between the panels and for the connection from the first panel of the string to the GRO. The conductors should be installed in the PNK cable trays. |  |  |  |
| **5** | **LIGHTNING INSTALLATION AND PROTECTIVE GROUNDING OF THE SOLAR FIELD**  **Quantity: 1 system**  **Minimal technical requirement:**  Protection against atmospheric discharge needs to be provided by the existing lightning protection, which has to be constructed in the form of a classic Faraday cage. Protective grounding is performed in accordance with applicable regulations. Protective grounding will be performed for the entire facility. All metal parts of the photovoltaic solar field equipment, carriers, photovoltaic modules, photovoltaic panel support poles and low voltage equipment need to be connected to the protective grounding system.  Lightning protection installation should meet the criteria for protection of systems with protection level No.3, i.e. the degree of efficiency Er should be in the range between 0.8 and 0.9 |  |  |  |
| **6** | **MC6 CONNECTORS SINGLE-CONTACT ELECTRICAL CONNECTORS**  **Quantity: 400 pieces** |  |  |  |

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| **All items** | **Installation** performed by contractor or authorised service provider. All the equipment must include all necessary parts and standards for its installation. |  |  |  |
| **All items** | Technical documentation for equipment (Operating manuals/ Users Guide/ Equipment operating instructions/ Cleaning procedures/ Maintenance procedures/ Calibration procedures) upon delivery. |  |  |  |
| **All items** | **Warranty**  Tenderers must provide local reliable warranty service agent providing maintenance and the rapid supply of equipment spare parts and consumables for the Warranty duration of one year.  Offer must include warranty service description including:   * Service organisation contact data including name, postal address, telephone number, fax number and e-mail address; * Help Desk (phone) support, which must be available during working hours, 8AM – 6PM; * Guaranteed maximum response time to submitted maintenance support request (fax or e-mail) of 1 (one) working day; * Guaranteed that any requests for services will be attended to within 24 hours; * Guarantee that all items can be repaired or alternatively replaced within a maximum of 72 hours; * Guarantee that genuine spare parts and consumables will be available for a period of minimum 3 years from the date of final acceptance of the equipment. |  |  |  |
| **All items** | **Commercial warranty**  1 year (after the end of 1-year standard warranty) in accordance with the conditions laid down in Article 32 of the General Conditions and Article 33 of the Special Conditions.  Detailed description of the organisation of the proposed service and description of the Manufacturer’s commercial warranty shall be included in the offer. |  |  |  |