Empowered lives.
Resilient nations.

Annex A – LOT 1
Terms of Reference

Title: Energy efficiency in multi-story residential buildings through switching from vertical to horizontal distribution of heat and hot water, within the residential block **"CCL 119 Chisinau, Hîncești Street, no.60/2"**.

Reference to the: Addressing the impacts of the energy crisis in the Republic of Moldova: Initiating solutions toward energy security and energy poverty" (FPI Programme)

Reporting to: Energy/Environment Cluster Lead

Duty Station: Chisinau, Moldova

Contract Type: Direct contracting

Duration: April 2023 - August 2023

A. BACKGROUND

Moldova is part of the EU's European Neighborhood Policy (ENP) and in the Eastern Partnership framework, which aims at strengthening individual and regional relationships between the EU and countries in its neighborhood. Moldova is also part of the Energy Community Treaty since 2010 and has signed the Association Agreement with EU in June 2014, including the DCFTA which entered into force in 2016. As a follow-up, Moldova is required to ensure transposition of the EU acquis Communities, which underpins the EU energy legislation on electricity, gas, oil, renewables, energy efficiency and environment.

The energy sector is one of the top priorities for the Government and it is approached in Government's Plans and a number of policy documents, laws and regulations.

The Republic of Moldova has no energy resources of its own and is practically completely dependent on imports of fossil fuels and electricity. Starting from October 2021, the Republic of Moldova faced a significant crisis in the natural gas sector, these developments took place against the background of the European gas crisis, when gas prices rose above 1000 USD/cubic meter (5-10 times the levels of 2020), which emphasized the need to take more actions in order to develop the energy security of the country. The natural gas crisis was also discussed during the meeting of the Moldova-EU Association Council on October 28, 2021, where the EU and Moldova emphasized the importance of resistance against any potential efforts by third parties to use energy as geopolitical leverage.

Under these circumstances, the Government of Moldova will be assisted to tackle the current energy crisis and energy poverty and addressing prioritized systemic elements in the energy sector to cope with a potential future energy crisis. In partnerships with EU, UNDP Moldova will therefore, support the Government of Moldova:

- To tackle the current energy crisis and energy poverty and addressing prioritized systemic elements in the energy sector to cope with potential future energy crisis.

- To support the Government of Moldova in building its capacities towards strengthening national energy security, as well as in improving the legal and regulatory framework and operationalizing specific rapid large-scale interventions to tackle energy poverty and support the most vulnerable and affected groups of population and businesses.

UNDP provided assistance to the Government to create a new energy subsidy system and an IT platform to support this effort starting with 2022/2023 heating season. In this sense, one of the components of the project is Demonstration/pilot project of energy efficiency measures to increase energy affordability and development of sustainable financing mechanisms with primary focus on vulnerable public sector, in particular *Refurbishment of the distribution heating system form the multi-story residential buildings connected to Chisinau district heating system (Chisinau DHS)*.

The initiative aims to help the apartment buildings from within 4 multi-story residential buildings, to reduce their bills by refurbishment of the distribution heating system from the selected multi story residential buildings connected to Chisinau DHS. The intervention will consist in switching from vertical to horizontal distribution of heat with installation of modern meters and individual heating substations to allow efficient and automatic operation of heating system in autumn and spring period and offering the possibility for beneficiaries to adjust the heat comfort in each apartment by adjusting the desired temperature and the qualitative supply with domestic hot water (DHW).

The project duration is envisaged between 2022- 2023 with support from Foreign Policy Instrument (herewith FPI) of EU.

B. OBJECTIVE OF THE ASSIGNMENT:

The general objective of the mission is to ensure professional works of engineering design, supply, installation, putting into operation and modernization of the heating agent and domestic hot water distribution networks, and where is necessary, the installation of individual heat substations within the residential block **"CCL 119 - residential multi-story building from Chisinau, Hîncești Street, 60/2"** tenant association connected to the Chisinau district heating system from the municipality of Chisinau, identified on the basis of a public and transparent expression of interest procedure.

All the entire volume of works that will be carried out in connection with the renovation, modernization of the heating agent and domestic hot water distribution networks, in the selected building, will be executed in compliance with all the requirements specified in this ToR, in accordance with the legislative and regulatory framework in force in Republic of Moldova, the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), and the design of General plan of the building (attached to this ToR).

C. INFORMATION ABOUT THE IDENTIFIED OBJECTIVE:

Abbreviations:

BoQ	Bill of quantities
Chisinau DHS	Chisinau district heating system
CW	Cold water
DH	District heating
DHW	Domestic hot water
DHWR	Domestic hot water recirculation
IHS	Individual heat substation
FPI	Foreign Policy Instrument
HS	Heat system
UNDP	United Nations Development Programme

BENEFICIARY:

Housing construction cooperative **CCL 119, Address: Chisinau, road Hincesti, 60/2** (President Ion Junghietu 069146528).

Year of construction: 1979.
Number of floors: 9 + basement.
Number of stairs: 2.
Number of apartments: 54.
Number of apartments with autonomous heating: 10.
Total area: 2904 m.p.
Thermal load for heating: 0.339 Gcal/hour.
Thermal load for domestic hot water: 0.093 Gcal/hour.
External wall surface: 2575.2 (without windows).
External wall material beton: (thickness 350 mm).
Partial thermal insulation of external walls (40%).
Window surface: 549 m.p. (including 65% thermal insulation).
Roof area: 509 m.p.
Basement area: 472.m.p.

Domestic hot water (DHW) is prepared in individual electric boilers.

General information about the parameters of radiators which are to be installed in the process of rehabilitating heating systems:

- Radiator - made of steel;
- Maximum working pressure: 10 bar;
- Maximum working temperature: 110°C;
- White color;
- Warranty - min 10 YEARS.

The preventive total number* of radiators, which is to be replaced per object CCL 119, Chisinau, str. Hincesti 60/2:

Radiator power (Watt) / Quantity	Floor 1	Similar floor (7 similar floors)	Floor 9	Total
746 (*But no less.)*	-	6(42)	-	**42**
895 (*But no less.)*	4	-	4	**8**
1044 (*But no less.)*	2	-	2	**4**
1194 (*But no less.)*	-	4(28)	-	**28**
1492 (*But no less.)*	3	5(35)	3	**41**
1641 (*But no less.)*	5	-	5	**10**
1790 (*But no less.)*	-	5(35)	-	**35**
2089 (*But no less.)*	6	-	6	**12**
Total radiators per object (unit):	**20**	**20(140)**	**20**	**180**

** The total number of radiators at this stage is calculated as guidance, just like the Radiator Power.*

** It should be noted that the total number of radiators might vary during the execution of the project steps, data that will be adjusted at the stage of works connecting the apartments to the newly developed heat distribution system.*

D. PROJECT STAGES AND BASIC REQUIREMENTS:

1. **<u>The main stages of the project:</u>**

<u>Stage 1 –</u> The selected contractor (Contracted companies) will sign a contract with UNDP to develop the design documentation by applying the most efficient technical solutions for the energy efficiency measures proposed in residential building, based on the technical characteristics and specifications for the new domestic hot water distribution system and the heating agent.

The selected contractor will design, supply and install individual heat substations (IHSs), new HS, DHW and DHWR distribution columns and distribution boxes in the stairwell, connecting columns to existing HIS, as well as install thermal energy and DHW meters for each apartment and IHS (including as is indicated in stage 2:

changing radiators, reconstruction works of the internal heating DHW and DHWR systems in the apartments, their connection to the distribution boxes/collectors and putting into operation).

The design will include detailed description of the following compartments:

- Preparation and repairs of room for installation of new IHSs in building;
- Installation of new IHSs in building;
- Connection of the new IHSs, HS, DHW and DHWR to the DH, CW, where applicable performing the ventilation procedure for HS, DHW, DHW recirculation systems;
- Connection and performing the electricity supply and data transmission (using new pipes, cables and all associated elements/accessories, etc.);
- Demolition of old piping, equipment and other elements, related to the reconstruction/installation of DH pipes, installation of new IHSs. All disassembled goods must be forwarded to the beneficiary or the managers of these goods;
- Construction of thermal energy and DHW distribution columns and distribution boxes in the stairwell, as well as installation of thermal energy and DHW meters for each apartment. Connecting columns to existing IHS.
- Execution of horizontal distribution works in apartments;
- Any other items/activities, as described in the present document and/or necessary to implement the items above, etc.

The design documentation is to be developed in Romanian, in 2 (two) originals on paper and on electronic format and will be consulted and coordinate with project beneficiaries, district heating companies JSC TERMOELECTRICA and the UNDP project implementation team.

The design documentation will also include the identification and provision of technical solutions for apartments that are currently disconnected from Chisinau DHS, and that will later want to reconnect to the new heating agent distribution system.

The documents, the designs and specifications, shall be of sufficient detail to enable construction to proceed without need for on-site instructions as to material selection, construction assembly, layout or location of any element or feature.

Stage 2 – The selected contractor will carry out of all necessary works inside the building and inside the residents' apartments to connect them to the newly developed heat and DHW distribution system, in accordance with the elaborated design documentation and requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR).

At this stage will be changed radiators, reconstruction works of the internal heating and DHW systems in the apartments, their connection to the distribution boxes/collectors and putting into operation. In this way, further horizontal distribution works will be executed in apartments: for heating - from thermal energy meters to radiators, with the change of the entire internal heating system network, including the radiators, within each apartment; for DHW - from the outlet of the water meters to the taps in the apartments.

The pipes of the actual HS and DHW systems that obstruct the construction of the new system will be dismantled and all disassembled goods will be forwarded to the beneficiary or the managers of these goods.

During the implementation of works the selected contractor will cooperate closely with the project engineer and the responsible engineers within the district heating companies (JSC TERMOELECTRICA), to ensure high quality works.

Stage 3 – After the completion of the works, it is expected that all parties involved in the implementation of the project, such as the Contractor, the Beneficiary of the project, the UNDP project implementation team, and JSC TERMOELECTRICA, will participate in the final reception of the works with the signing of the appropriate documentation and the closing process of the project.

2. Requirements of service render for development of clear and complete designs:

2.1. **Designs**: Complete detailed construction designs of all works in sufficient detail for tendering, contractual and construction purposes. All designs shall be presented in electronic (PDF) format and on appropriate paper support. All designs should be clear, sharp and accurate. Symbols and abbreviations should be defined in a legend.

2.2. **Bill of quantities (BoQ)**: Complete for all items of work with adequate description for each item. The quantities for all work items should be based on actual take-off calculation and not based on estimates. All BoQs shall be presented in a spreadsheet format, preferably MS Excel.

Important: The BoQs should be entirely presented (either in Romanian), in the following formats: Form 7, Form 5, Form 3 (according to WinSmeta). Please note that, Form 7 should be submitted in Excel.

2.3. **Specifications**: Comprehensive and up to date, in accordance with current best practices, general and particular Technical Specifications for all works and equipment based on internationally accepted standards and sufficient for procurement, installation and construction works.

2.4. **Accompanying documents:** Documentation of all design literature and design calculations for all civil, structural, electrical, automation and mechanical works.

2.5. **Cost estimations**: comprehensive estimation of involved costs taking into account all necessary labor and materials based on current prices available on the local market and manpower remuneration, which shall be not below the minimum required by the National Legislation.

2.6. **Reliability:** The designs should comply with the government norms, standards and specifications, and the local building regulations and shall ensure:

1. Reliable and safe operation of equipment, materials and systems;
2. Performance requirements of the hot water supply system and heat agent;
3. Optimal energy efficiency of operation;
4. Cost efficiency in terms of construction, operation and maintenance;
5. Compliance with occupational health and safety requirements.

3. Work execution requirements:

The new systems and facilities shall be designed and shall contain all the equipment and materials, according to the rules and regulations in force in the Republic of Moldova, the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), with all the requirements specified in this ToR, and the design of General plan of the building (attached to this ToR).

All the entire volume of works that will be carried out in connection with the renovation, modernization of the heating agent and domestic hot water distribution networks, in the selected building, will be executed in compliance with all the requirements specified in this ToR, in accordance with the legislative and regulatory framework in force in Republic of Moldova, and the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR).

According to the legislation of the Republic of Moldova the design work shall be carried out by designers and design entities certified/licensed in the Republic of Moldova.

The Contractor shall obtain all necessary technical conditions, approvals and other documents from relevant authorities, utilities and other. All costs for obtaining the necessary approvals and documents shall be borne by the Contractor.

The selected contractor will comply with the legal norms of labor protection, according to the legislation and norms in force in the Republic of Moldova, such as:

- Law No. 186 of 10.07.2008 on safety and health at work;
- Law No. 721 of 02.02.1996 regarding quality in construction;
- Government Decision No. 353 of 05.05.2010 regarding the approval of minimum safety and health requirements at the workplace";

- Government Decision No. 362 of 27.05.2014 regarding the approval of the minimum requirements for the protection of workers against the risks to their health and safety generated or which may be generated by exposure to noise, especially against risks to hearing;
- Government Decision No. 589 of 12.05.2016 regarding the minimum safety and health requirements at work regarding the exposure of workers to risks generated by mechanical vibrations;
- Government Decision No. 80 of 09.02.2012 regarding the minimum security and health requirements for temporary or mobile construction sites;
- NCMA 8.02:2014 Safety and health at work in construction.

The following European norms shall be met by the complete system:
- EN 253 Pre-insulated bonded pipes.
- EN 448 Fittings assemblies.
- EN 488 Valves assemblies.
- EN 489 Joint assemblies.

The manufacturer shall operate a quality assurance system according to ISO 9001.

The Contractor undertakes to develop design documentation and to execute the entire volume of works in compliance with all the requirements specified in these technical specifications, respecting the legislative and regulatory framework in force in the Republic of Moldova, requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), and the design of General plan of the building (attached to this ToR).

Deviations regarding the quality of the execution of the works established by the design specifications and requirements of Avizul de racordare issued by JSC TERMOELECTRICA, will not be accepted.

E. GENERAL INFORMATION ABOUT HEAT SUPPLY SYSTEMS FOR HEATING AND DHW FROM CHISINAU.

1. General data about Chisinau DHS from the municipality of Chisinau.

– Working duration of Chisinau DHS: 365 days/year;
– Duration of the heating season: 166 days/year;
– External temperature for design: -16°C;
– Temperature graph in the DHS 95/55°C (primary circuit);
– Temperature graph in the internal HS 70/50°C (secondary circuit):
– Indoor air temperature:
  - Rooms and dormitories +20...+22°C;
  - Entrance hall and cooks +18°C.

2. Conditions / parameters for delivery of the thermal agent in Chisinau DHS.

Chemical parameters of the thermal agent:

– chemically treated water (mains water)	
– free carbonic acids	0
– Dissolved O_2	≤20μg/l
– pH	8,5-10,5
– Fe	≤0,5 mg/l
– Carbon index	≤0,1(mg echiv/l)^2.

F. TECHNICAL SPECIFICATIONS FOR DESIGN AND EXECUTION OF WORKS FOR INDIVIDUAL HEAT SUBSTATION

1. Specific technical requirements for IHS

The contractor undertakes to develop design documentation and execute the entire volume of work related to the individual heat substations, in strict compliance with all the requirements specified in these technical specifications and the requirements presented in Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), in accordance with the legislative and regulatory framework in force in the Republic of Moldova, and the design of General plan of the building (attached to this ToR).

Deviations regarding the quality of the execution of the works established by the design specifications and requirements of Avizul de racordare issued by JSC TERMOELECTRICA, will not be accepted.

2. General data for heat exchangers.

– All equipment must be CE certified;
– Built from brazed plates;
– Plates made of AISI 316 stainless steel;
– Bonding material between plates - Copper;
– Equipped with easily removable prefabricated insulation.

The documentation for IHS will also contain the information related to the heat exchangers:

– The manufacturer;
– Type;
– Maximum admissible pressure;
– Serial number and year of production;
– Maximum thermal load;
– Direction of liquid flow, projected on both sides (primary and secondary);
– Water volumes (primary and secondary);
– Maximum working temperature;
– Maximum working pressure.

2.1. Requirements for selecting heat exchangers for HS.

The primary circuit tour	95°C
Primary return circuit	55°C
The secondary circuit tour	70°C
Secondary return circuit	50°C
Pressure losses Primary circuit maximum	20 kPa
Pressure losses Secondary circuit maximum	20 kPa

2.2. Requirements for the selection of exchangers for the preparation of DHW.

The primary circuit tour	62°C
Primary return circuit	22°C
DHW supply	55°C
CW (cold water)	10°C
Pressure losses Primary circuit maximum	30 kPa
Pressure losses Secondary circuit maximum	30 kPa
Preparation of domestic hot water in two steps	6 connection
To provide the DHW recirculation line	according to the project

3. Requirements for selecting circulation pumps for HS.

– All equipment must be CE certified;
– they must be equipped with high efficiency engines not lower than IE 3;
– motor protection degree: IP 44;
– terminal box protection degree: IP 54;
– insulation class: F;
– Circulation pumps must be equipped with a frequency converter, equipped with pressure sensors to maintain the preset pressure in the secondary circuit;
– The pumps must be equipped with control modules for signaling and monitoring their operation;
– The pumps must be mounted with the possibility of easy disassembly, without the need to disassemble other components;

- Type: wet or dry rotor pumps (in case of necessity);
- Pump casing material: cast iron or corrosion resistant materials;
- Mounting: round or return (according to the designer's decision);
- Connection: flanges or threads;
- Pump axis: stainless steel, ceramic or materials resistant to limestone and corrosion;
- Feeding: ~220 V (±10%), 1 phase, 50 Hz;
  ~380 V (±10%), 3 phase, 50 Hz (as the case);
- The pumps must work without noise and vibration.

4. Requirements for selecting DHW recirculation pumps.

– All equipment must be CE certified;
– they must be equipped with high efficiency engines not lower than IE 3;
– motor protection degree: IP 44;
– terminal box protection degree: IP 54;
– insulation class: F;
– Made of bronze or stainless steel to withstand water with increased oxygen content;
– The pumps must be mounted with the possibility of easy disassembly, without the need to disassemble other components;

- Type: wet rotor pumps;
- Pump casing material: bronze or stainless steel;
- Pump axis: stainless steel, ceramic or materials resistant to limestone and corrosion;
- Connection: flanges or threads;
- Feeding: ~220 V (±10%), 1 phase, 50 Hz;
- The pumps must work without noise and vibration.

5. Requirements for selecting temperature regulators with servo motor.

- Temperature controllers for HS and DHW must be equipped with electric drive elements (servomotor) with manual control capabilities. The operation elements must have the force to close against a pressure difference of 3 bar;
- Correct, noise-free operation is achieved at differential pressures in the system between 0.5 and 3 bar;
- The speed of the thermal agent through the regulating valve must not exceed 3.0 m/s to achieve noiseless operation;
- Two-way flow regulation valve;
- Flow characteristic of the regulating valve – linear;
- Adjustment – proportional;
- Connections must be with flanges or threads;
- The material of the regulating valve body must be steel, ductile iron or bronze;
- The material of the seat, cone and rod must be stainless steel or better materials resistant to corrosion and limestone.

Controller behavior in the event of a power failure:

- for HS: fixing the servomotor in the position at the time of the power failure;
- for DHW: return to the closed position (return spring);
- The servomotors must be compatible with the controllers, selected and delivered together with the control valve as an assembly;
- Running time from closed/open position: up to 150 seconds for HS (rod travel – no more than 20 mm) and no more than 60 seconds (rod travel – no more than 10 mm) for DHW servomotors;
- For DHW servomotors the supply voltage ~24V/~220V AC; for HS ~220V AC;
- All equipment must be CE certified.

6. Pressure regulator selection requirements.

- Regulators must automatically maintain set values for the pressure or pressure difference of the thermal agent in the pipes on the primary circuit;

- The "downstream" or "upstream" pressure regulator must ensure the calculated flow rate and pressure and will be included in the principle diagram if necessary;
- Actuation principle: hydraulic (without electric servomotors);
- In the event that the pressure value in the return pipe of the primary circuit is insufficient to fill the secondary circuit of the heating system, the installation of the pressure regulator after the connection point of the addition line in the direction of flow movement will be provided;
- Depending on the parameters P1 and P2, the mechanisms for actuating the regulators must be dimensioned so that the speed of the flow through them does not exceed the value of 3.0 m/s;
- The occurrence of cavitation at the pressure regulation valve will be excluded;
- The degree of opening of the actuation mechanism must be 30 - 70%;
- Ball valves must be installed on the impulse lines of the pressure regulators;
- Connections must be with flanges or threads;
- All equipment must be CE certified.

7. Safety valve selection requirements.

Each heat exchanger must be equipped with its own safety valve installed in the secondary circuit before the first set of shut-off valves, for protection against overpressure when the valves are closed and heat is supplied to the primary circuit.

The valve must be selected according to the thermal expansion of the heating agent and will have a connection size of at least DN15.

Safety valves will also be installed for both the HS and the DHW system. Safety valves must be adjustable. The sensitivity of the valve must not exceed the value of 0.5 bar.

8. Requirements for the selection of expansion vessels.

The contractor will deliver and install, together with IHS, expansion vessels for HS. They must be of the closed type, with a pressurized membrane. The volume of the expansion vessels will be calculated based on the water volume of the HS.

- Nominal pressure of the expansion vessels: 6.0 bar;
- Initial pressure: 2.5-3 bar;
- Maximum working temperature of the membrane: not less than +70°C;
- All equipment must be CE certified.

9. Requirements to the control panel.

The IHS must be designed for automatic operation and must be equipped with all necessary control and safety equipment. The control units will ensure the automatic operation of the IHS and will keep the parameters within the admissible limits.

The temperature regulator with electrical action (controller) must:

- Has a keyboard that allows setting the necessary parameters;
- Show operating parameters, set values and information about faults on a display;
- All equipment must be CE certified.

In the HS menu:

- Minimum temperature for HS – adjustable;
- Regime – Active (depending on the outside air temperature) / Passive (do not stop the pump);
- Operating mode: Summer / Winter;
- The possibility of programming the temperature graph for HS;
- The possibility of programming the HS disconnection temperature depending on the outside air temperature;
- The possibility of calibrating the outside air temperature sensor, HS circuit and DHW;
- Weekly programming for HS.

In the DHW menu:

- DHW temperature programming;
- Programming of the DHW recirculation pump – days/hours (independently or together with DHW);
- Weekly programming for the DHW system;

- The possibility of "DHW priority" programming.

Temperature regulator with electrical action (controller) must ensure:

- Automatic adjustment of the temperature of the thermal agent supplied in HS according to a graph depending on the outside air temperature;
- Keeping the temperature of the thermal agent in the HS with a maximum deviation of no more than ± 5°C from the programmed value, displaying and memorizing the values measured by the temperature sensors of the DHW, HS, the outside air sensor and the pressure sensor in graphic form;
- Transmission of all parameters displayed in the control panel via RS 485 for connection to the existing SCADA system (Mode Bus transmission protocol);
- Automatically adjusting and maintaining the DHW temperature within ± 5°C (± 10%) of the set temperature.

The control equipment must:

- Ensure the protection of the pumps it runs empty;
- Ensure the control of the operation of pumps, regulating valves, pressure sensors;
- Display the status of the pumps (on / off / error);
- Have alarm signal outputs for remote data transmission in the monitoring system;
- Be password protected to prevent unauthorized manipulations;
- Be equipped with a timing relay.

The control unit will display alarms in case of:

- Deviation greater than ± 5°C (adjustable value) of the flow temperature, the HS secondary circuit, compared to the required value according to the preset temperature chart;
- Deviation greater than ± 5°C (adjustable value) of the DHW temperature compared to the programmed value;
- Pressure drop in the return pipe of the secondary circuit below the limit;
- Damaged pump stop;
- Power failure.

In the event of a power failure, all settings and recorded data must be preserved. After removing the power failure, the IHS should be restarted automatically. For this purpose, back-up power supply modules will be provided for the data collection and transmission equipment, in order to ensure the continuity of the transmission of the data recorded within the IHS, in the event of an interruption of the electricity supply from the 220 V network.

Basic processes to be performed by the module:

1. In the event of a power cut from the 220V public network, the module will automatically connect:
   a. the data transmission equipment within the SCADA system to the emergency power source – the batteries within the module, which must ensure uninterrupted operation for at least 6 hours;
   b. thermal energy meters connected to the SCADA system to the 3.6 V battery that is mounted inside the meter.
2. When the voltage in the 220V network appears, the module will switch the supply of meters and data transmission equipment to the public network through the 12V power supply block and will ensure the charging of the batteries within the module.

10 Technical requirements for data transmission equipment.

- Ensuring the connection for the transmission of data from monitoring equipment equipped with the RS 485 interface. The configuration of the reading parameters must be universal by finalizing the code ABCCCCCC in the case of monitoring another type of non-specified monitoring device.
- Connecting an electricity meter that does not have RS 232/485 interfaces, the optical communication port with the IEC 62056-21 model C reading protocol must be provided, which will be an integrated part of the object of purchase.
- Data transfer must be performed using 3G/4G technology.
- The minimum set of data inputs: 4 digital inputs and 4 analog inputs with the possibility of expansion
- Operating regime of the equipment - 24/24h.
- Equipped with a real time clock.

- The data must be provided to the client's server (in the case of the need to purchase the server, the technical requirements for the server will be established by the contractor taking into account the complexity of the software and its expansion possibilities and will be an integral part of the object of purchase), through the network Intranet (the client's private internal network) and accessing them from the outside using Internet technology through a protected channel with restricted communication access.

11. Requirements for pressure and temperature sensors.

The IHS must be equipped with the necessary temperature sensors, such as:

- Outdoor air temperature sensors: compatible with the controller, designed and protected with a suitable level for installation on the wall facade.
- Temperature sensors for monitoring the temperature of the thermal agent in the HS (tour/return), must be installed on the secondary pipes of the HS.
- Temperature sensors (2 units) for monitoring the DHW temperature (one connected to the control panel, the other to the thermal energy meter) and the primary circuit, must be mounted at the exit from the heat exchangers (the distance no greater than 100mm).
- Adjustable pressure sensor (pressure switch) for the protection of the DHW pump against it runs empty or low pressure, they must be installed at the suction. If the pressure drops to a dangerous level for the pump, it must automatically shut it off.
- Pressure sensor with analog signal type (0...30 V, 4...20 mA) for monitoring the pressure in the SI secondary circuit and against it runs empty or low pressure, it must be mounted at the intake. If the pressure drops to a dangerous level for the pump, it must automatically shut it off.
- Pressure sensors with analog signal type (0...30 V, 4...20 mA) for monitoring the pressure in the primary flow and return circuit (P1/P2).
- A pressure sensor (pressure switch) must be installed on the DHW pipe that will interact with the operation of the DHW regulating valve. It will cut off the electrical power supply to the drive elements (servomotor) during the cold water line depressurization, after the automatic servomotor closes (due to the return spring). When the pressure in the cold water line appears, the servomotor will restart automatically.
- Signaling sensor for water leaks (on the floor) connected to the control panel.
- All equipment must be CE certified.

12. Equipment requirements for the addition line.

The IHS must be provided with devices for supplying the secondary circuit with heating agent in manual mode (on/off) and must include:

- Ball shut-off valves;
- Filter;
- Electromagnetic valve (position - normally closed);
- Mechanical water meter with pulse output;
- One-way valve;
- Manometers.

To avoid flooding in the rooms - to provide for the operation of the addition line in automatic mode with a time relay.

13. Requirements for manometers and thermometers

13.1. Manometers:

Place of installation	***Scale***	***Size***
Chisinau DHS	0-16 bar	Ø ≥ 100 mm
HS	0-10 bar	Ø ≥ 100 mm
DHW, CW	0-10 bar	Ø ≥ 100 mm

The measuring scale of pressure gauges must be in MPa, bar or kgf/cm^2. Pressure gauges must comply with the SM SR EN 837-1:2013 "Manometers" standard.

The manometers shall be metrologically tested.

13.2. Thermometers:

Place of installation	*Scale*	*Size*
Chisinau DHS	0-120°C	L=120 mm
HS	0-100°C	L=120 mm
DHW, CW	0-80°C	L=120 mm

All thermometers must be submersible, clip type are not accepted. Resolution of the thermometer scale - 1°C. Thermometers must comply with SM EN 50446:2017 standard "Straight thermocouple thermometers with protective tube, metal or ceramic and accessories".

The thermometers shall be metrologically tested.

14. Requirements of meters

14.1. To record electricity consumption at IHS, it is necessary to install an electricity meter with RS 232 output to ensure the connection in the existing SCADA system.

14.2. In order to record the thermal energy consumption, it is necessary to install a thermal energy meter that meets the requirement of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR):

14.3. In order to record domestic hot water consumption, it is necessary to install a water meter on the cold water pipe that meets the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR):

14.4. In order to record the consumption of supplementary water, it is necessary to install a mechanical water meter with pulse output on the supplementary line that meets the following requirements:

- The meter type must be mechanical with a dry dial,
- Made of stainless material;
- Equipped with pulse output with 1 l/i resolution, 2-wire connection cable, minimum 1.5 m;
- Temperature of the measured medium (hot water) 0...90°C;
- Measurement error, maximum ±2%;
- With a degree of protection of at least IP 54;
- They must be equipped with antimagnetic protection devices;
- All components must be provided with elements that would allow them to be sealed.

Water meters must meet the requirements of the SM EN ISO 4064:2017 standard.

At the same time, the meter models mentioned in points **14.1 - 14.4** must be included in the *State Register of Measuring Instruments allowed for use in the Republic of Moldova*, have an updated model approval certificate granted by the National Metrology Institute, and each meter in part - of metrological verification bulletin with a valid term or have an initial CE metrological verification mark, applied in the year of installation of the IHS.

15. Supplying IHS with electricity.

Power supply works for each IHS must be carried out by the Contractor. IHS's electricity supply must be carried out from the electricity supplier in accordance with the issued technical conditions. The contractor will ensure the signing of the trilateral agreements issued by "Premier Energy" SRL. The installation of the installation will be carried out in accordance with the developed project, coordinated with the UNDP project implementation team and approved by JSC TERMOELECTRICA the contractor will carry out the putting into operation works and complete the execution documentation.

All costs of admission, coordination, verification, etc. will be borne by the contractor.

All cabinets/panels must be made of galvanized metal and painted.

The distribution panel must be located inside the IHS room near the entrance to ensure easy disconnection of the power supply in case of water leakage inside the IHS room.

Electrical equipment and installations must comply with the provisions of the Technical Normative Documentation (TND) in force on the territory of the Republic of Moldova. The record and protection board of the electric meter must be mounted in the immediate vicinity of the IHS.

All cables must be copper with double flame retardant insulation. The degree of protection of the electrical power distribution panel must be at least IP 54.

Power supply of IHS: 1 phase, ~220V (±10%), 50Hz, TN-S or ~380V (±10%), 50Hz (according to the project).

16. IHS assembly.

The IHS must be manufactured and assembled by the Contractor at the factory or in specialized workshop conditions. It must be possible to operate the equipment set both simultaneously (heating + DHW) and separately (heating or DHW). The dimensioning of the assembled IHS will be carried out by taking into account the dimensions of the room in which the IHS will be installed, but not smaller than 2000×1000×1500 (height) mm, if no other dimensions are indicated, and to meet the seismic requirements for design Richter scale: 8 degrees.

The contractor will check and measure the dimensions of the room, access ways and doors to ensure that the prefabricated IHSs fit the given room. The IHS construction must be made so that it can be introduced into the room, through the access doors, with the prior dismantling of the IHS components and its subsequent assembly without the use of welding.

The IHS shall be installed so that they are accessible for inspection, operation and maintenance. Sufficient space shall be provided for access to equipment.

The prefabricated substation units and other equipment shall be installed on appropriate foundations and supports.

IHS must be installed on foundations by means of anti-vibration seals. Antivibration elements and fittings shall be installed to prevent propagation of vibration. Measures shall be taken to minimize noise and vibration, to ensure silent operation of the equipment and to exclude propagation of any vibration through the building or systems.

All electrical equipment must be installed at least 1 meter above floor level.

The contractor will at his own expense replace any equipment damaged during transportation, installation, putting into operation of the IHS.

The contractor is required to install valves (DN15 or larger) on each heat exchanger (DHW exchangers with recirculation line - six valves) to allow the water or heat agent to drain from the system.

Valves must be easily accessible and equipped with a blind cover. Ball valves must be fitted to the impulse lines of the pressure regulators to shut them off during routine repairs.

The expansion vessels must be installed in the IHS room on separate foundations, equipped with a tap for the possibility of draining the water from the expansion vessel.

A water drain signaling sensor (on the floor) connected to the control panel must be installed in the IHS room.

The pressure testing of the assembled IHS is performed by the Contractor, and the signed test report must be delivered to J.S.C. TERMOELECTRICA, together with IHS, a copy of the report being presented to the project manager of the UNDP project.

17. IHS rooms.

The Contractor shall propose locations (room) in the same buildings for installation of the IHS.

Identification and selection of location (room) for installation of the IHS will be coordinated and consulted with project beneficiaries, district heating companies JSC TERMOELECTRICA and the UNDP project implementation team.

Where possible, the substations shall be installed under auxiliary rooms and (particularly in residential buildings) under staircases or other common areas.

Prior to installing the IHS, the Contractor shall prepare the IHS rooms, including the necessary repairs and construction works.

The rooms for IHS shall correspond to the requirements of the relevant norms.

All work shall be carried out in accordance with the applicable norms and regulations acting in the Republic of Moldova.

The works for preparing the HIS rooms shall include, as necessary in each case (but not be limited to):

- Demolition of existing equipment, if any;
- Repairs of the walls and ceiling (levelling, plastering and painting);
- Repairs of the floor (leveling and applying appropriate surface, ensuring drainage pit or drains with connection to sewerage where available, making foundations for equipment);
- Where the IHS rooms have windows – installation of new windows with steel bars (in most cases the substation rooms do not have windows);
- Installation of steel doors with locks;
- Necessary intake and exhaust ventilation facilities shall be provided.

New lighting equipment, including new energy-efficient light fixtures with appropriate protection class, shall be installed, including the necessary wiring and light switches. The IHS rooms shall have sufficient lighting for service and maintenance.

IHS rooms exit doors shall open outwards if possible. There shall be visible notices stating that access for unauthorized persons is prohibited.

The floor of the IHS rooms shall be covered with ceramic or another applicable type of tiles and shall have roughened surface. The floor shall be leveled and have drains for draining water into the sewage system or shall have a drainage pit in the case a sewage connection is not available. Foundations for equipment (prefabricated substations, expansion tanks, etc.) shall be prepared. Waterproof plinths made of ceramic tiles (height at least 10 cm) shall be installed to prevent moisturizing of the walls in case of water leakage on the floor.

G. TECHNICAL SPECIFICATIONS FOR DESIGN AND EXECUTION OF WORKS REGARDING OF THE COMMON HS, DHW AND DHWR PIPES INSIDE THE BUILDING:

1. Overview.

Contract includes design, supply and installation of individual heat substations, new HS and DHW distribution systems, including recirculation DHW, to be installed through the basements and in the common areas in residential building identified above, to enable individual horizontal connection of each apartment using individual thermal energy and DHW meters.

This shall include:

- Horizontal HS, DHW and DHWR main pipes through the basement of the building - from the IHS substation to the new risers (in case of necessity);
- Vertical HS, DHW and DHWR risers through the common areas in each entrance staircase of the building;
- On each floor shall be installed distribution boxes, to be connected to the HS and DHW risers, designed to accommodate the following elements: headers (collectors), shut-off valves, check valves, filters, balancing valves, automatic heat and DHW meters with remote data reading - for connection of all of the apartments and other eventual consumers on the respective floor (including any apartments/consumers currently disconnected / not connected to DH services).

The design, all the works, materials and equipment's shall respect the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), in accordance with the legislative and regulatory framework in force in the Republic of Moldova, and the design of General plan of the building (attached to this ToR).

All the pipes and fittings shall be insulated to minimize heat losses.

Cutting of holes for installation of the pipes through concrete walls and floors shall be carried out using diamond cutting tools.

The Contractor shall identify optimal locations for installing the new risers and the distribution boxes in the common areas. The location shall be agreed with the project beneficiary, the UNDP project implementation team and JSC TERMOELECTRICA.

Depending on the optimal solutions for the connection of the apartments/consumers on each floor and for the accommodation of the pipes and equipment inside the boxes, it can be proposed to install more than one distribution box on each floor.

The distribution boxes shall be prefabricated and made of metal (factory-painted), with locks, and shall have openings for installing the pipes for connecting the apartments.

The HS pipes will design taking into consideration the possibility of DHW-priority operation – the capacity of the DH pipes shall cover:

- The full heating loads of the building; plus
- The average DHW loads of the building.

The diameters of the HS pipes installed shall not be smaller than the ones indicated in the designs.

Piping design will be done with the provision of additional capacity for the future connection of additional consumers/apartments who are currently disconnected from the central heat supply system (Chisinau DHS) and that will later want to reconnect to the new heating agent distribution system.

Individual meters for measuring heat energy and hot water consumption for each apartment must meet the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR).

2. Installation of pipes

The Contractor shall plan and install all pipe runs to fit neatly into the space available with due consideration to other services and systems, installations and equipment and to allow access for maintenance purposes.

All pipe work shall be free from burns and shall be thoroughly cleaned before erection.

Butt ends of pipe shall be reamed out to their original bore before fitting.

Parallel horizontal pipe runs must have their supports (including any insulation) at a common level.

Horizontal runs shall have a slight gradient to facilitate venting and draining of the system.

Reduction of pipe sizes shall be carried out with reducing tees, reducers or sockets. Bushing down will not be accepted.

Contractor shall allow free space for pipe expansion and contraction in the layout.

Supports and hangers must allow space for the necessary movements of the pipes and, if needed, expansion loops and fittings shall be included in the piping.

In all cases where pipes pass through walls, floors, ceilings, etc. metal sleeves shall be inserted in the building structure. The sleeves shall have a diameter one dimension larger than the pipe, or in case of insulated pipes, one size larger than the finished insulation.

Pipe supports shall be provided on both sides of equipment that will be serviced and maintained: meters, strainers, etc.

Anchoring of pipes shall be according to the manufacturer's recommendations.

The use of perforated bands or wire chain as hangers is not acceptable.

Support clamps for pipes and riser clamps shall be premanufactured and installed as per the manufacturer's recommendations.

Venting of pipes shall be arranged for manual and automatic operation.

The Contractor shall provide venting for the whole system.

The new pipes systems shall be designed and installed according to the rules and regulations in force in the Republic of Moldova, the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), and the requirements specified in this ToR.

3. Painting

Prior to mounting the insulation, the steel pipes, fittings, flanges and weld necks shall be cleaned and painted with a 40 µm layer zinc dust corrosion protective paint and one 80 µm layer of surface finish vinyl- or acryl color paint. The corrosion protective paints shall be applied in accordance with the paint manufacturer's instructions and in accordance with good practice for paintwork.

The paintwork includes that on all steel installations, pipes and equipment, supports, fixtures, hangers and accessories, etc. which are not surface finished from the factory/assembling plant.

The colors shall be approved by the Employer. All painting shall be carried out prior to commencing insulation.

4. Insulation and insulation cover.

The insulation shall be carried out with due consideration to access to field instrumentation. All equipment which is possible to inspect or dismantle shall be insulated with removable insulation.

Parts subject to high temperature shall be protected from human touch. Piping of the primary and secondary side of a IHS shall be insulated. Short pipe sections (less than 100 mm) that do not present a hazard to operating and maintenance staff do not require insulation.

Pipes connecting the IHS to the systems shall be insulated.

The insulation cover (non-corrosive metal sheet) shall be installed by professional journeymen.

5. Equipment and pipe marking and identification.

All installed equipment shall be provided with text signs which clearly describe their function and operation.

All valves, pumps, etc. shall have an identification tag made of plastic with an engraved number. The numbering system shall be agreed with the Employer Pipe identification shall be applied as plastic bands with flow direction and system name at each end and every 10 meters and minimum one identification in each room. The system names shall be in Romanian and according to a specification agreed with the Employer.

The labeling system shall be systematically developed and agreed with the Employer.

The Contractor shall install in each IHS room (on the wall) a schematic of the respective substation, enclosed in plastic, readable size (not less than A2 format). The schematic shall reflect the equipment identification/tagging used for the equipment and pipes.

H. TECHNICAL SPECIFICATIONS FOR DESIGN AND EXECUTION OF WORKS REGARDING THE INSIDE OF RESIDENTS' APARTMENTS TO CONNECT THEM TO THE NEWLY DEVELOPED HS, DHW AND DHWR.

HS, DHW and DHWR distribution systems in residential apartment.

The design, all the works, materials and equipment's shall respect the requirements specified in these technical specifications and the requirements presented in Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR), in accordance with the legislative and regulatory framework in force in the Republic of Moldova, and the design of General plan of the building (attached to this ToR).

I. EXPECTED DELIVERABLES AND ESTIMATED TIMEFRAME.

	Deliverables, Description/Specification of Services	Estimated Delivery Date
Deliverable #1	Elaboration and presentation of the design documentation for the object (site), for the construction of the IHS, reconstruction of the internal heat supply systems, DWH and DHWR, with the transition to the horizontal distribution of the thermal agent, for coordination with the UNDP team and JSC TERMOELECTRICA.	30 days without authorized Verification, and 45 days with authorized Verification (from the date of signing the contract)
Deliverable #2	Preparation of the detailed program for the execution of the contract, using the critical path method of the GANT scheme, or other programs used at the international level.	70 days since the date of contract signature
	Preparation and repairs of room for installation of new IHS in building.	
	Delivery and installation new IHS.	

Deliverable #3	Installation of vertical columns and distribution boxes/collectors for thermal energy, DHW and DHWR, at each stairwell, as well as installation of thermal energy and DHW meters for each apartment and IHS. Connecting columns to existing IHS.	90 days since the date of contract signature
	Delivery and changing, reconstruction works of the internal heating, DHW and DHWR systems in the apartments, their connection to the distribution boxes/collectors and putting into operation.	
Deliverable #4	Pressure testing of the new integral HS and DHW distribution system assembled, including recirculating DHW and IHS, the final reception of the works and the signing of the appropriate documentation.	90 days since the date of contract signature
	Final report and presentation of acts of reception of the works (in 3 original copies), related to the testing, putting into operation, installation of new IHSs, installation of vertical columns and distribution boxes/collectors for thermal energy, connecting HS, DHW and DHWR columns to IHS, installation of thermal energy and DHW meters for each apartment and IHS, changing radiators, reconstruction works of the internal heating, DHW and DHWR systems in the apartments, connection to the distribution boxes/collectors and putting into operation with the newly developed distribution system.	105 days since the date of contract signature

J. GENERAL REQUIREMENTS.

1. Mandatory requirements for equipment to be taken into consideration upon offer preparation.

- The proposed equipment must be produced no earlier than 2021;
- The warranty period of the equipment - minimum 24 months from the date of putting into operation;
- Certification CE of equipment;

2. Specifications regarding accompanying documentation.

- The Contractor shall provide the complete design and other technical documentation, which will be presented in two original copies.
- The technical documentation for the equipment will be presented in the original language and translated into Romanian (2 copies) including:

A) For IHS:

- Technical documentation for the equipment with specifications of the materials used, including their types/grades and chemical compositions of metals and/or alloys used for manufacturing the principal components;
- Complete design documentation with necessary approvals;
- Complete design documentation from the manufacturer for the prefabricated substations, including schematics, equipment specification, layout drawings, detailed electrical schematics, minutes from factory tests, etc.;
- As-built drawings;
- Technical documentation for the data transmission systems;
- Technical "passport" of the equipment;
- Complete installation manuals;
- Complete operating manuals;
- Maintenance and repair manuals with specification of regular works, their scopes and terms;
- Necessary documents and metrological certificates for the metrological devices and meters;
- Warranty certificates for installed equipment's and for executed works;
- Certificates of conformity for equipment;
- Other documents required according to the Moldovan legislation.

B) For new SH, DHW and DHWR distribution systems

The Contractor shall provide the complete design and other technical documentation for the SH, DHW including recirculation of DHW, distribution systems for residential apartment buildings, including:

- The design of the new SH, DHW, DHWR risers through the common areas of the buildings; of the distribution boxes for each floor, including the SH, DHW meters for each apartment/customer and all the other necessary elements; of the optimal pipe routing from the distribution boxes to each apartment on the respective floor; of SH and DHW systems for each type of apartment.
- Complete installation manuals for installed equipment's;
- Complete operating manuals for installed equipment's;
- Necessary documents and metrological certificates for the meters;
- Warranty certificates for installed equipment's and for executed works;
- Certificates of conformity for equipment;
- Other documents required according to the Moldovan legislation.

– The mounted equipment and mounting schemes must correspond to the developed and approved projects;

– The proposed equipment must ensure, during the period of operation, the minimum safety and health requirements according to the rules of the Republic of Moldova in force, in particular:

- Law No. 721 of 02.02.1996 regarding quality in construction.
- Government Decision No. 353 of 05.05.2010 regarding the approval of minimum safety and health requirements at the workplace.
- Government Decision No. 362 of 27.05.2014 regarding the approval of the minimum requirements for the protection of workers against the risks to their health and safety generated or which may be generated by exposure to noise, especially against risks to hearing.
- Government Decision No. 589 of 12.05.2016 regarding the minimum safety and health requirements at work regarding the exposure of workers to risks generated by mechanical vibrations.
- Government Decision No. 80 of 09.02.2012 regarding the minimum security and health requirements for temporary or mobile construction sites.
- NCMA 8.02:2014 Safety and health at work in construction.

The execution documentation must be sent on paper with the necessary signatures and coordinates and in electronic format .docx or .pdf - the documents, .vsd - the schemes.

3. Conditions for receiving works/services.

- Upon completion of the works/services, the Contractor will notify the Project Beneficiary, the UNDP project implementation team and JSC TERMOELECTRICA about it and will indicate the date of the tests.
- The works will be isolated or hidden only after testing and approval by the working group consisting of representatives of the Contractor, the Project Beneficiary, the UNDP project implementation team and JSC TERMOELECTRICA;
- Pressure testing of IHS and the new HS and DHW distribution systems (including DHWR) in building, is applied in accordance with the requirements of Avizul de racordare issued by JSC TERMOELECTRICA (attached to this ToR) and normative acts and standards in force in the Republic of Moldova.
- The beneficiary of the project together with the UNDP project implementation team and JSC TERMOELECTRICA is to receive the works/services performed within **15 days** by signing the act of reception of the works, or to remit to the Contractor within the same period the refusal to sign the given act with the indication of objections.
- The term provided for the reception of the works/services may be extended depending on the complexity of the procedure for the reception of the performed works.
- If the existence of any shortages and/or deficiencies is found, they will be brought to the attention of the Contractor, establishing the necessary deadlines for completion or remediation.
- The liquidation of the shortages and deficiencies is carried out at the expense of the Contractor, including the part of the materials necessary for their removal.

- After the liquidation by the Contractor of all objections, the parties will carry out the reception again. Depending on the findings made, the Beneficiary of the project together with the UNDP project implementation team and JSC TERMOELECTRICA will approve or reject the reception.
- The reception of the works will be done by designing up and presenting the work execution documentation for the columns and for each individual apartment, which will contain:
    - the report of testing the equipment and networks;
    - the act of examination of hidden works;
    - certificates of conformity of all materials used and technical passports for equipment and networks;
    - network execution scheme;
    - copy of the certificate of the welders who performed the welding.

K. GENERAL COORDINATION AND PAYMENT

Overall coordination of the implementation of the project will be carried out by the UNDP project team. Contracted companies will report to Project Manager and UNDP Energy and Environment Cluster Lead.

The Contractor will submit payment requests (supported by reporting deliverables mentioned in the compartment "**I. Expected deliverables and estimated timeframe"** above).

The payments will be disbursed upon approval by the Policy Specialist of the provided reporting deliverables.

L. PERIOD OF PERFORMANCE

The expected time of commencement of the Contracts is April 2023. The services shall be completed within 105 days, but not later than August 4th, 2023.

UNDP will require maximum of **15 (fifteen) days** to review the deliverables, provide comments, approve or certify acceptance of deliverables.