United Nations Children's Fund/ WASH programme

Terms of Reference:

Power to Learn: Supply and Installation of Solar power Energy, roof Rainwater Harvesting, and Greywater Recycling Systems for Integrated Water and Energy Management in Schools in Erbil, Duhok and Ninawa governorates.

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Power to Learn: Supply and Installation of Solar power Energy, roof Rainwater Harvesting, and Greywater Recycling Systems for Integrated Water and Energy Management in Schools in Erbil, Duhok and Ninawa governorates.

Section	Content
Background	In recent years, Iraq has faced increasing challenges related to climate change, water scarcity, and deteriorating infrastructure issues that have particularly impacted the education sector. These challenges have severely disrupted schools' ability to provide essential Water, Sanitation, and Hygiene (WASH) services, with frequent water shortages undermining the functionality of sanitation systems and hygiene practices. The situation is further exacerbated by recurring global health crises, which have underscored the critical need for clean water and hygienic learning environments. A key driver of these challenges is the unreliable electricity supply from the national grid, forcing many schools to depend on diesel generators. This dependence leads to high operational costs, logistical difficulties, increased greenhouse gas emissions, and, most critically, inconsistent water supply during school hours, compromising both learning conditions and public health. These factors have contributed to unhealthy and inadequate school environments, which are among the drivers of school dropout and limited access to education. According to recent data from the Government's Out-of-School campaign, a total of **16,615 children** (comprising **9,677 boys** and **6,938 girls**) remain out of school across the three governorates of Ninewa, Duhok, and Erbil, highlighting the urgent need for climate-resilient and inclusive interventions within the education sector. In response, this project proposes an integrated and sustainable solution: the installation of solar power systems to provide clean, reliable electricity and the deployment of Internet of Things (IoT) technologies to enable real-time monitoring and smart management of both energy and water consumption in schools, grey water recycling system and roof rainwater harvesting techniques. These systems will optimize resource use, enhance operational efficiency, and ensure continuous functionality of critical WASH infrastructure. By transforming the 10 selected schools into models of environmental sustainability and digital innovation, the project will strengthen the resilience of essential services while fostering a culture of climate awareness and responsible resource management. The initiative aligns with Iraq's national climate priorities and directly supports the achievement of key Sustainable Development Goals—specifically **SDG 6 (Clean Water and Sanitation)**, **SDG 7 (Affordable and Clean Energy)**, and **SDG 13 (Climate Action)**. Ultimately, the project aims to create safe, inclusive, and climate-resilient learning environments that empower students and educators to thrive in a rapidly changing world. It is also aligned with UNICEF office priority "Climate" under Data/ modeling and quality. The project seeks to transform school infrastructure into 10 schools across Erbil,

Project Description	Duhok, and Ninawa by deploying renewable energy systems, grey water recycling system and roof rainwater harvesting techniques and innovative water management solutions. It aims to address the persistent challenges of inconsistent electricity supply and water scarcity, which adversely affect educational quality and student well-being. By installing solar power systems and linking schools to UNICEF's existing Internet of Things (IoT) platform, the initiative will enable real-time monitoring and optimized management of energy and water use. In doing so, the project will contribute to reducing greenhouse gas emissions, strengthening energy security, and advancing Iraq's national climate objectives, ultimately creating safer, more resilient, and environmentally sustainable learning environments. The initiative encompasses the following components: 1. Solar Power System Installation: Schools will be equipped with high-efficiency solar panel systems, complete with battery storage, to ensure a reliable and sustainable energy supply. These systems will power essential school operations, including water pumping system, lighting, and ventilation for the (WASH) facilities and the classrooms, thereby improving sanitation standards and enabling a healthier learning environment. 2. IOT: The schools will be integrated into the Internet of Things (IoT)-based platform for real-time monitoring of solar power output and water usage, Carbon reduction. This platform will provide data analysis tools for comprehensive energy and water management. 3. Wastewater Treatment and Recycling: Implementation of the Eco-Filtration Greywater System (EFGS), a simpler yet effective wastewater treatment solution, will enable schools to recycle greywater efficiently. This treated water will be utilized for irrigating green landscapes both within and surrounding school premises, contributing to a greener school environment and community spaces. This initiative not only supports the greening of environments but also promotes sustainability principles among students, fostering a culture of environmental stewardship and awareness. 4. Roof rainwater harvesting: Design and implement roof rainwater harvesting (RRWH) systems in selected schools to improve climate resilience, enhance water availability, and promote sustainable water management practices. The RRWH will capture and store rainwater from school rooftops for non-potable uses such as handwashing, toilet flushing, and school garden irrigation. The intervention includes technical assessments, system design, installation of collection and storage components, and training on operation and maintenance. In addition to reducing reliance on external water sources, the project will serve as a practical platform for environmental education, water conservation and climate adaptation. The project not only addresses immediate infrastructural needs but also aligns with broader environmental goals, teaching students the importance of green energy and water conservation through direct experience.

Objectives & Expected results	**Objectives:** • **Ensure Sustainable Energy Access:** Install solar power systems in targeted schools to provide a reliable and clean source of electricity, addressing frequent power disruptions. The systems will prioritize energy needs for classroom lighting, ventilation, and water access, thereby improving the overall learning environment and reducing dependence on costly, polluting diesel generators. • **Enhance Digital Monitoring and Efficiency:** Integrate participating schools into Internet of Things (IoT) platform to enable real-time monitoring and smart management of energy and water systems. This will improve operational efficiency, promote data-driven decision-making, and support long-term sustainability planning. • **Advance Environmental Sustainability:** Promote the use of renewable energy and efficient water management practices to lower greenhouse gas emissions and introduce a culture of sustainability within school communities. • **Strengthen Educational Outcomes:** Leverage intervention as a learning opportunity to raise awareness among students and staff about renewable energy, water conservation, and climate-smart practices by embedding sustainability into education. **Expected Results:** • **Reliable and Clean Energy Access:** Increased adoption of green solar energy in schools, leading to enhanced reliability of electricity, reduced carbon emissions, and lower operational costs. • **Digital Innovation for Sustainability:** Integration of selected schools into an IoT-based monitoring system, enabling real-time tracking and smart management of energy and water consumption, improving operational efficiency. • **Environmental Impact:** Measurable reductions in carbon emissions and improvements in water use efficiency, contributing to climate resilience and responsible resource use. • **Contribution to Global Goals:** Tangible progress toward achieving the **Sustainable Development Goals** particularly **SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), and SDG 13 (Climate Action)** through localized, innovative action.

Scope of Work	**Scope of Work for Enhancing School Infrastructure:** This initiative is dedicated to significantly upgrading selected schools across Iraq by integrating cutting-edge solar power systems and IOT platform for data driven and effective management, grey water recycling and roof rainwater harvesting. It directly tackles the critical issues of unreliable electricity supply, water scarcity and furthers the adoption of sustainable environmental practices within the educational sector. A key objective is to harness solar energy not only for a reliable electricity

	supply but also specifically to enhance both WASH facilities and classroom environments through improved lighting and ventilation, aligning with modern educational infrastructure standards. • **Preliminary School Selection Criteria and Assessments:** Prior to detailed project execution, an initial joint technical and demographic assessment of schools is undertaken between UNICEF, DoE and the contractor to ensure eligibility and readiness for the integration of solar power systems, IOT, grey water recycling and roof rainwater harvesting. This assessment phase encompasses: • **Structural Integrity and Suitability**: Evaluation of school buildings for structural integrity, with a focus on the suitability of roofs for solar panel installations and the water network and distribution in the schools for the IOT, ensuring that physical infrastructure can support project components. • **Electrical Infrastructure and Power Availability:** Examination of the existing electrical infrastructure and analysis of power availability, including grid connectivity and the typical number of electricity supply hours per day. This helps in designing a solar system that complements the current power setup and meets the school's energy needs. • **Environmental and Safety Assessments:** Identification of potential environmental impacts and safety considerations associated with project implementations, ensuring compliance with environmental mitigation measures and safety protocols. The scope of work for this multifaceted project includes: • **A. Solar Power System Implementation:** **1. Power Generation and Storage:** • **Solar Panels:** • **Type & Efficiency:** Monocrystalline, N-Type, Half-Cut Cell, Bifacial, Minimum rated capacity: 610 Wp per module, Module efficiency: ≥22.5%, Temperature coefficient (Pmax): between −0.20% /°C and −0.30% /°C, Busbars: Multi-busbar design, not less than 9, Operating temperature: −40°C to +85°C. • **Capacity & Standards:** Different capacities (20 Amp, 40Amp according to school need and as reflected in the BoQ (continuous supply for daytime hours (8 hours from 8:00am to 4:00pm) and 5 Amp continuous supply for nighttime hours (10 hours from 5:00pm to 3:00 am). Panels must conform to IEC 61215, be TUV Rhineland certified, and comply with ISO, BS, and UV standards for durability and performance. • **Battery Storage:** Providing Lithium-ion Battery system ensuring sustainable power according to the BOQ requirements and technical specifications, selected for their robust performance across temperature variations and their deep cycle capacity for prolonged energy storage. • **Inverter:** According to the BoQ items requirement, inverters efficiently convert DC from solar panels and batteries to AC, incorporating an ATS

changeover circuit from leading brands for seamless power transition**.**

- **Automated Solar Panel Cleaning/Washing system**: Installation an automated cleaning system for the solar panel system to ensure full efficiency of the system and timely cleaning.
- **Energy Management System (EMS):** Integrate an EMS for optimal control and monitoring of energy production, storage, and consumption, featuring predictive analytics and automated adjustments to enhance system efficiency.

2. <u>Lighting and Environmental Control:</u>

- **LED Lighting Upgrades:** Replace existing lighting with LED fixtures to significantly reduce energy consumption while providing superior illumination in the WASH facilities.
- **Load distribution:** The contractor shall be responsible for separating the electrical load into heavy and light categories within each school if required. This includes all necessary wiring work, installation of circuit breakers, and any additional accessories required to ensure a safe, efficient, and properly balanced power distribution system.

<u>3. Sustainable water source:</u>

- **Pumping Solutions:** Power schools' water and booster pumps by the solar setup, to ensure sustainable water sources in the school.

<u>4. Monitoring and Data Management (the system in Place and the new schools shall be integrated into this system)</u>:

- IoT-based platform for monitoring solar power output and water consumption, featuring a user-friendly website for real-time data access.
- Display key metrics on the platform, including power generation (with 10W resolution) and water flow (with 1-liter resolution), **updating every 15 seconds.**
- Ensure data continuity during power or internet outages and facilitate wireless connectivity between sensor, flow meters, units and the master control unit.
- Integrate comprehensive data analysis tools to report on energy usage, water consumption, GPS location, user demographics, system maintenance needs, carbon footprint reduction, and more.
- Ensures 4G internet access for the entire system for at least two years including all the associate running costs.

B- Enhanced Structural Engineering Procedure for Solar Panel Support Systems:
The engineering process for designing and installing solar panels support structures on school roofs is a critical component of the overall project, ensuring the safety, durability, and effectiveness of the solar power installations. This enhanced procedure outlines a comprehensive approach, from initial assessments to final certifications, incorporating specific engineering standards and practices.
Initial Site and Structural Assessments

	• **Roof Evaluation**: The process shall begin with coordination with the relevant Directorates of Education (DOEs) to obtain any available initial design documents and structural analysis data for the school roofs. This will support a comprehensive evaluation of each roof's structural integrity, including an assessment of construction materials, age, condition, and load-bearing capacity. In cases where such documentation is not available, the contractor will be required to coordinate with the DoEs and perform on-site inspections using appropriate testing methods (e.g., core sampling, rebound hammer, ultrasonic testing, or other approved techniques) when needed. These inspections must be conducted through a certified and approved governmental construction laboratory. A detailed and endorsed structural assessment report shall be prepared and submitted for each school roof.
	• **Data Collection for Environmental Loads**: Collect region-specific environmental data, including wind speeds, snow loads, and other relevant conditions. For wind load, refer to local building codes or the American Society of Civil Engineers (ASCE) standards, ensuring calculations account for the worst-case scenario wind speeds recorded in each governorate.
	
	<u>Design of Steel Frame Structures:</u>
	
	• **Steel Sections Design-Based Specification**: The selection of steel sections and their thickness for the support structure will be rigorously determined through design calculations. This process ensures that each dimension is optimized for structural demands, including load-bearing capacity and environmental resilience.
	  • **Corrosion Resistance**: Galvanized steel is chosen for its corrosion resistance, essential for the longevity of the structure under various environmental conditions.
	  • **Calculated Thickness**: Thickness will be precisely calculated based on structural analysis, incorporating the weight of solar panels, potential environmental forces (wind, snow), and maintenance considerations, ensuring the framework's adequacy and durability without over-specification
	• **Load Analysis**: Perform a comprehensive load analysis, considering the weight of the solar panels, the steel frame itself, wind loads, potential snow loads, and maintenance loads. This analysis will guide the design process to ensure all factors are adequately addressed.
	• **Connection Design Strategy**: Implement an advanced connection design strategy for the steel framework, focusing on ensuring the system's resilience to both static and dynamic stresses for enhanced long-term stability and safety. This strategy concentrates on:
	  • **Uplift Resistance**: Tailor connections to effectively withstand uplift forces from high winds or extreme weather, securing the solar panels firmly to the structure. The design incorporates specific mechanisms to distribute these forces evenly, safeguarding against panel detachment or structural damage.
	  • **Mitigating Joint Failure**: Utilize cutting-edge design elements to significantly reduce the potential for joint failure, which is vital for

	the solar support system's integrity. Employ reinforced bolting, welding, and other securing techniques to bolster joint strength and resilience under variable loads. • **Thermal Flexibility**: Design connection points to accommodate the steel structure's thermal expansion and contraction without impacting its integrity. opt for materials and fasteners designed for elasticity and strength across temperature changes, ensuring a consistently strong connection <u>Footing design and Load Transfer Analysis:</u> • **Advanced Footing/Base Plate Design:** Focus on the creation of specialized footings or base plates tailored for rooftop installations. These elements are designed to uniformly distribute the imposed loads across the roof structure, integrating advanced anchoring methods to secure the installation against sliding, overturning, and uplift forces. • **Roof Slab Material and Structural Analysis**: The initial phase of the analysis focuses on an in-depth examination of the concrete roof slab, specifically evaluating its material properties and structural capabilities. This critical assessment encompasses: • **Concrete Compressive Strength (f'c)**: The analysis will review or assume the concrete's compressive strength in megapascals (MPa), taking a conservative approach to account for variability in material quality across different construction periods or practices. • **Steel Reinforcement Tensile Strength**: The tensile strength of the steel reinforcement, also expressed in MPa, will be assessed or assumed based on the type and grade of steel used within the slab. This will help in understanding the slab's resistance to tensile forces. • **Slab Thickness and Reinforcement Distribution**: A meticulous evaluation of the slab thickness will be conducted, alongside an analysis of the reinforcement distribution within the slab. Where exact details are unavailable, assumptions will be made based on the worst-case scenario to ensure a comprehensive safety margin in the analysis. This includes considering the most adverse reinforcement layout that could affect the slab's load-bearing capacity. • **Load Capacity Assessment**: Integrating these material specifications, the analysis will precisely calculate the slab's capacity to support the additional loads from the solar panel system. This includes the static weight of the steel frames and panels, dynamic loads from environmental conditions such as wind or seismic events, and any maintenance-related loads. • **Structural Integrity Recommendations**: Based on the findings, specific recommendations will be formulated regarding any required slab reinforcement or modifications. This may involve suggestions for increasing slab thickness, enhancing reinforcement density, or using higher-grade materials to ensure the roof can safely support the new loads without risk of structural failure • **Sealing and waterproofing of solar frame anchor bolts on concrete slab**

roof using high-grade epoxy system: Supply and apply a high-grade, two-component epoxy resin system for sealing anchor bolts fixed into the concrete roof slab. The epoxy shall be non-shrink, chemical- and UV-resistant, with high adhesion to both concrete and metal surfaces (this needs to be based on the structural design of the bolt and anchorage system). The application shall include:

- Cleaning and preparation of bolt holes and surrounding surface, including removal of dust, grease, etc.
- Injection or trowel application of high-grade structural epoxy adhesive (e.g., Sikadur®-31 CF, or equivalent) around anchor bolts.
- Shaping and smoothing to ensure a watertight finish that prevents water ingress around all penetrations.
- Topcoat of the high-grade structural epoxy around bolt zones to ensure long-term protection.

Note:
All assumptions made during the footing and load transfer analysis including the slab properties (f'c, fy, reinforcements, etc.) must be realistic and justifiable to UNICEF. Assumptions should be backed by data or sound engineering principles. Where assumptions introduce uncertainty, direct measurements or tests are preferred to ensure the accuracy and safety of the project.

Engineering Documentation and Certification

- **Detailed Design Documentation**: Prepare comprehensive design documentation, including drawings, specifications, and calculation sheets for the steel frame structure, connections, and foundation designs. This documentation will detail every aspect of the design process and the rationale behind each decision.
- **Certification by Licensed Professionals**: All design work and analyses should be prepared and certified by a licensed professional, engineering firm or institution with the authority to approve structural designs. This certification ensures compliance with local and international engineering standards, building codes, and safety regulations.
- **Governorate-Specific Approvals**: Obtain necessary approvals from local governing bodies in each governorate, ensuring the designs meet or exceed local requirements for structural safety and environmental resilience.

The contractor is responsible for all tasks outlined in the above three points, Engineering Documentation and Certification section, including preparing and submitting design documentation, obtaining necessary certifications.

Quality Control, Training, and Maintenance

- **Quality Assurance**: Enforce rigorous quality control measures throughout the construction and installation phases to meet or exceed project standards.
- **Comprehensive Training**: Equip school staff with necessary operational and

maintenance knowledge, ensuring the system's longevity and efficiency.

- **Maintenance Planning**: Develop a proactive maintenance schedule, covering all aspects of the system from civil work to mechanical components, supported by regular monitoring to ensure optimal performance

Comprehensive Scope of Work for Greywater Treatment Integration in Schools

Joint Initial Assessment and System Selection

- **Water Usage and Wastewater Generation Analysis:** Conduct an in-depth assessment of the schools' water usage and greywater generation to accurately size the Eco-Filtration Greywater System (EFGS).

Greywater Technology Selection: Based on the initial analysis, select a greywater treatment system tailored to each school's requirements. This assessment will be a collaborative effort involving UNICEF, DoE, and the Contractor. Considerations include:

- The volume of greywater to be treated.
- Installation space available.
- Maintenance and operational needs.
- Energy efficiency and environmental sustainability.

Eco-Filtration Greywater System (EFGS) Overview:

- **System Configuration:** Implement the EFGS which consists of a primary treatment component, which can be an underground reinforced concrete tank or an above-ground HDPE tank, for greywater collection and sedimentation.
- **Secondary Treatment:** Install above-ground sand and carbon filters to remove suspended solids and absorb organic compounds, ensuring treated water is suitable for irrigation.
- **Pumps and Electricity:** Equip the system with energy-efficient pumps for transferring greywater from the collection tanks to the filtration units.
- **Quality and Compliance:** Ensure the system components and design comply with all local environmental, health, and safety standards for greywater treatment and reuse.
- **Installation and Training:** Provide full installation services, including connection to existing greywater sources, and comprehensive operational staff training for ongoing system management and maintenance.

Additional Notes:

- The system will prioritize ease of maintenance, cost-effectiveness, and long-term operational sustainability.
- Final system adoption will be subject to UNICEF's approval, ensuring alignment with the project's goals and sustainability criteria.
- The EFGS will be designed to meet or exceed the effluent quality standards for non-potable reuse applications such as irrigation

Civil Works and Structural Design

Reinforced Concrete Tank, Foundation Design and Construction

- **Design and Foundations:** Develop comprehensive designs for reinforced concrete tanks and associated raft foundations. The design will address structural requirements for both underground and above-ground setups, ensuring a stable base for the tanks and filtration system, capable of enduring loads, environmental conditions, and ground movement.
- **Walls and Support Structures:** Construct tanks with reinforced concrete walls and necessary support to manage hydrostatic pressure, environmental stress, and resist corrosion from greywater, suitable for both the collection of greywaters in underground tanks and the support of above-ground HDPE tanks.
- **Construction Quality:** Maintain high standards of construction quality, with consistent monitoring and quality control measures to ensure structural integrity, longevity, and compliance with environmental safety standards.

Pipeline System Design and Installation

- **Selection and Installation**: Determine appropriate materials and sizes for the pipeline network, according to the BoQ pipe sizes/materials, installing and rigorously testing the system to guarantee seamless operation and integrity, with emphasis on long-term serviceability and maintenance access.
- **Sanitation System Upgrades**: Modify existing sanitation and plumbing infrastructure to connect effectively with the new wastewater treatment system, optimizing wastewater collection and treatment.

Excavation and Site Preparation

- **Strategy and Management:** Develop a comprehensive excavation plan tailored to the site's soil types and groundwater conditions, ensuring minimal disruption and adherence to safety standards. Maintain a clean and orderly site throughout the process, with clear signage and warning tape to enhance safety and operational efficiency.
- **Soil Handling and Infrastructure Protection:** Excavate all soil types with precision, storing topsoil for site restoration. Implement measures to prevent damage to existing infrastructure; promptly repair and adjust any impacted facilities to maintain functionality.
- **Debris Management**: Responsibly manage and remove debris and waste materials. All debris shall be transported out of the building site in accordance with the directions of the supervision committee and with municipality approval for designated dump areas, ensuring compliance with environmental regulations**.**
- **Installation and Pre-Concrete Preparation:** After installing tanks and pipelines, thoroughly compact the excavated areas to ensure ground stability and prevent subsidence. Carefully check and ensure all connections and alignments are correct, and that the infrastructure is properly supported

and level before proceeding to concrete casting.
- **Compaction and Restoration:** Once the concrete has been cast and cured, restore the site to its original or improved condition.

Mechanical Components and Filtration System Specifications
Pump Installation:
- **Specifications:** Supply and install submersible greywater pumps as per the selected size and capacity detailed in the BoQ to accommodate the treatment system's requirements. Pumps should be of high quality, energy-efficient, and suitable for continuous operation.
- **Electrical Works:** Include all necessary electrical cabling, connectors, and accessories, ensuring they comply with the system's specifications and are sourced from reputable manufacturers, as stipulated in the BoQ.

Sand Filter and Activated Carbon Filter:
- **Design and Capacity:** Supply and install sand and activated carbon filters according to the sizes and capacities specified in the BoQ. Ensure the filters are capable of treating the anticipated greywater flow rates and are suitable for the intended reuse application.
- **Construction and Media:** Filters must be constructed from materials that are durable and appropriate for the specified operating conditions. The sand and carbon media should be of a quality that ensures effective treatment and longevity, with the provision for easy maintenance and replacement as detailed in the BoQ.

All installations must adhere to local environmental and health safety standards, with the contractor ensuring compliance with the specified effluent quality standards.

HDPE Tanks for Collection and Treated Water Storage:
- **Versatile Usage and Capacity:** High-density polyethylene (HDPE) tanks, manufactured from virgin, non-recycled materials, will serve dual purposes within the treatment system: as initial collection points for greywater and for storing treated water post-filtration. The size of these tanks will be selected based on actual needs, as determined by a comprehensive needs assessment and detailed in the Bill of Quantities (BoQ).
- **Quality and Durability:** The tanks will be chosen for their high quality, durability, and resistance to environmental stressors, ensuring compatibility with both greywater and treated water storage requirements, and adherence to health and safety standards.
- **Installation:** Tanks will be installed appropriately, either above ground or below ground, considering site-specific conditions and system layout to facilitate ease of access and maintenance

<u>Quality Control, Training, and Maintenance</u>
- **Quality Assurance**: Enforce rigorous quality control measures throughout the construction and installation phases to meet or exceed project standards.
- **Comprehensive Training**: Equip school staff with necessary operational and

maintenance knowledge, ensuring the system's longevity and efficiency.

- **Maintenance Planning**: Develop a proactive maintenance schedule, covering all aspects of the system from civil works to mechanical components, supported by regular monitoring to ensure optimal performance.

Comprehensive Scope Roof rainwater harvesting (RRWH): The contractor will be responsible for the full implementation of the RRWH systems at identified school sites, including but not limited to the following:

A. Site Assessment and Design: Conduct field surveys at each school site to assess:

- Roof type, size, slope, and condition.
- Existing gutter systems and the need for any change and new installation.
- Available space for tank placement and overflow drainage.
- Accessibility and safety (for operation and maintenance).
- Record GPS coordinates, photos, and roof dimensions.
- Analyze historical rainfall data (monthly and annual) for each location.
- Determine required storage capacity based on school size and capacity.

B. System Design Specifications: The system shall include the following components, with all materials conforming the alignment with national standards:

1- Catchment and Conveyance: Use of existing school roof and conduct
   - roof cleaning (remove dirt, debris, leaves, bird droppings, and mold which can contaminate harvested rainwater.
   - Roof slope: create the required slope to the required level in all directions to ensure smooth water flow to the different water gutters (roof drain system).
   - Roof Sealing & Waterproofing: Prevent water leakage into the building by identifying cracks if any and treating it with suitable materials and coating the entire roof with waterproof painting to extend roof life and improve water quality by eliminating cracks or exposed joints. All the materials shall be **non-toxic, water-safe, and free hazardous solvents**.

2- Pre-Treatment:
   - uPVC and UV resistance gutters (minimum 6") and downpipes (4") with appropriate and required slopes. Secure fastening with brackets and protection from dislodgement.
   - Leaf guards/screens at gutter inlets.

3- Storage Tank: HDPE tanks, three layers, modular if space constrained. Elevated or ground-mounted on a concrete base (Thickness and reinforcement details shall be calculated based on structural and engineering calculation), Inlet, outlet, overflow, and drain connections with valves and screened covers. Overflow connected to the closest drain/rainwater systems or school garden via a closed pipe.

4- **Distribution System:** Tap stand with a small pump for reusing the water for cleaning and washing/cleaning along with a hose with a length not less than

	50m. C. **Construction and Installation:** - Procure and deliver all materials and equipment to each site. - Construct civil components (tank base, fencing around tank, etc.). - install all RRWH components as per approved designs. - Label tanks and components for educational and maintenance purposes. - Conduct water leakage, flow, and overflow testing. D. **Training and Handover:** Train school staff and selected students on system use, safety, and basic maintenance. Provide user manual and O&M guide in Arabic/Kurdish and English **for the Solar system, IOT, Grey water recycling and the RRWH.** Prepare and deliver an "as-built" technical report for each site (drawings, specs, and performance). **Notes on the Attached Bill of Quantities (BoQ):** The BoQ details various items required for the project, with specifications to accommodate different types, sizes, and requirements across schools. The application of these items will be adapted based on actual site assessments, specific needs of each school, and decisions made by UNICEF. This adaptive approach ensures that the implementations are tailored to maximize efficiency, effectiveness, and sustainability in alignment with the unique contexts of each school. Other items listed in the BoQ may also vary and are subject to final selection based on the specific requirements and decisions by UNICEF.

Deliverables	**Deliverables** 1. **Solar Power Systems (for the 10 targeted schools)**: • Supply and Installation of high-efficiency solar panel systems (solar panels, inverter, battery storage, and all the required adaptors/tools for the data transfer of the IOT system) in selected schools, complete with all necessary infrastructure modifications. • Supply and Installation of LED lighting for essential areas, particularly WASH facilities, powered by solar systems. • Supply and installation of Automated Solar Panel Cleaning/Washing system for timely cleaning the solar panel system. 2. **Integrating the 10 schools into the existing Monitoring and Data Management Platform (IoT-based platform for monitoring solar power output and water consumption, featuring a user-friendly website for real-**

time data access: This monitoring platform exists with the following specification:

- A user-friendly IoT-based platform for real-time monitoring of solar power output, water consumption, and user demographics, including the number of students, teachers, and workers. This platform, equipped with data analysis tools for comprehensive energy and water management, will be accessible in English, Kurdish, and Arabic to accommodate all users
- Features update every 15 seconds on power generation (in Amps) and water flow, alongside GPS location tracking, maintenance alerts, and water leakage notifications.
- Includes graphical analyses and reports on water usage, leakages, and carbon impact, updated monthly and yearly. Ensures data storage with a 2-year 4G internet subscription and website hosting for continuous accessibility and monitoring. Ensuring backup and data storage for the entire period of the 2 years.

The contractor is responsible for integration of the 10 schools into the existing system with all required modifications and renewals. the subscription and 4G-internt for two years for continuous accessibility and monitoring:

3. **Engineering Documentation and Certifications**:

- Comprehensive design documentation for the solar panel supports structures and installations, including structural assessments and load analyses.
- Certification of all designs and installations by licensed professionals, engineering firm or institution ensuring compliance with engineering standards and local regulations.

3- Greywater Treatment Systems (for one school in Duhok):

- Custom-designed and installed Eco-Filtration Greywater Systems (EFGS) tailored to the needs of each school, including all civil works like reinforced concrete or HDPE tank construction and pipeline installation.
- Integration of treated water for irrigation or other non-potable uses, ensuring compliance with local environmental standards.
- The following table outlines the expected water quality parameters post-treatment **(one satisfactory test before the preliminary handover and one satisfactory test at the final handover stage),** ensuring the treated water meets environmental standards and is safe for intended reuse applications:

- **Table 1: Expected Water Quality Characteristics Post-Treatment**

	Quality for effluent (Treated Water)	Result Value
	Flow (M3/Day)	According to the Schools/ institutions generated grey wastewater
	Biochemical Oxygen Demand (BOD)	Less than 40 mg/L
	Chemical Oxygen Demand (COD)	Less than 100 mg/L
	TSS – Total Suspended Solids	Less than 60 mg/L
	PH	6.0 to 8.5
	Turbidity	Less than 10 NTU
	Oil And Grease (mg/L)	Less than 10 mg/L
	Odor	Nil
	Floating Materials	Nil

4. Roof rainwater harvesting (**for one school in Ninawa**): Custom-designed and installed Roof rainwater harvesting system (RRWH) tailored to the needs of each selected school, including all the work (site assessment, design package, water proofing, HDPE tank construction and pipeline installation. Integration of treated water for irrigation or other non-potable uses, ensuring compliance with local environmental standards.

5. **Training Programs and Maintenance Plans**:

- Training for School/ Institution Staff: Deliver operational and maintenance training programs for the staff of schools, focusing on the functionalities, efficient use, and upkeep of both the solar power systems and IOT platform.
- Maintenance Schedules and Protocols: Develop and provide detailed maintenance schedules and protocols that outline regular upkeep tasks, troubleshooting tips, and procedures for common issues.
- Comprehensive Documentation:

	Operational Manuals and Protocols: Provide operational manuals that detail the startup, operation, repair, and maintenance procedures, enabling the school staff to understand and manage the systems effectively. Multilingual Manuals: Make available operating and maintenance manuals (solar power system, IOT, Grey water recycling, RRWH) in English, Arabic, and/or Kurdish, catering to the linguistic preferences of the staff. 5. **Quality Control and Compliance Reports during the warranty period**: • Regular quality control checks and reporting to ensure the systems meet performance and safety standards. • Documentation of compliance with environmental regulations and contribution towards achieving SDGs.

Project Execution and Oversight	**Quality Assurance and Compliance** • **Material Standards and Workmanship**: The Contractor is required to submit materials and **equipment samples, along with Certificates of Origin,** for Supervision Committee and UNICEF approval. This step ensures all project materials comply with technical specifications and adhere to reliable International and Iraqi standards. • The supervising committee reserves the right to reject any materials not meeting the required specifications. In such instances, the contractor must replace the non-compliant materials at no additional cost. Additionally, the site engineer may request tests to verify the quality of materials and workmanship. Only materials and workmanship that have received approval will be used in the project. **Site Management** • **Site Cleanliness and Waste Management**: Maintain cleanliness across the project site and ensure responsible debris disposal. Obtain necessary approvals for all concealed works before moving forward, aligning with environmental and safety standards **Health, Safety, and Environmental Management** • **Safety Practices and Environmental Compliance**: Develop and implement Health & Safety and Accident Prevention Plans in alignment with UNICEF's zero tolerance policy towards corruption, fraud, and child labor. These plans must ensure the safety of all employees and visitors on-site and incorporate environmental protection practices. **Warranty Responsibilities** • After preliminary handover, the contractor enters a **1-year warranty period,** undertaking maintenance and support to rectify any operational issues and

	guarantee long-term system functionality. This commitment is crucial for maintaining project integrity and performance standards**. <u>Ensuring that the manufacture warranty of the 5 years for the panels and inverter is arranged beyond the 1-year warranty</u>.**
Reporting, Monitoring, and Final Handover	To ensure transparency and accountability throughout the project lifecycle, comprehensive reporting on various milestones is mandated. These reports will serve as formal documentation of progress, key decisions, and project completion stage **Progress and Meetings Documentation** • **Bi-Weekly Updates**: Submit bi-weekly reports detailing progress, challenges, and achievements. Include minutes of meetings and ensure reports are provided in a timely manner to facilitate payment processing. **Handover Reports** • **Preliminary Handing Over Report**: Upon physical completion of all works, a technical report must be submitted, detailing the execution phases in alignment with the Bill of Quantities (BOQs), any time adjustments made, and including signed delivery notes. This report must be accompanied by an official cover letter endorsed by the Handover committee/ school administrations. **Final Project and Warranty Period Report** • A thorough final report, submitted post-warranty period, must detail the outcomes of training sessions, lists of participants, and include an official approval letter from the handover committee. This serves as confirmation of the project's satisfactory completion and training effectiveness. • The warranty period involves contractor obligations for maintenance and support, ensuring the system's functionality. Upon fulfilling these responsibilities and successful project outcomes, the final handover process includes obtaining a completion certificate from the handover committee, marking the project's official closure.
Variation Order Management	Managing variations in the project scope, quality, or quantities is crucial to meeting objectives while accommodating necessary adjustments. This process is governed by the following steps: 1. **Variation Requests**: Contractors must submit formal requests for any scope, quality, or quantity variations, including BoQ changes. These requests should outline the variation's nature, rationale, and expected impact on project execution and outcomes. 2. **UNICEF Review and Approval**: • **UNICEF's Authority**: UNICEF reserves the right to make necessary variations to work scope, quality, or quantity, including changes in the BoQ. • **Review Process**: Upon receiving a variation request, UNICEF will review the necessity and feasibility of proposed changes, assessing their impact on project goals, budget, and timeline. • **Decision Making**: Decisions on variation requests will be made solely by UNICEF, with formal notifications issued to the contractor. This ensures clear documentation and mutual understanding.

	3. **Implementation of Approved Variations**: • **Contractor's Role**: Upon UNICEF's approval, variations must be documented and executed according to UNICEF's directives, ensuring alignment with agreed standards. • **Adjustments in BoQs**: Approved variations may lead to adjustments in BoQs, which require endorsement by all stakeholders, including the Supervision committee and/ or school administration, and UNICEF. 4. **Valuation of Work**: • **Using BoQ Rates**: For comparable work, existing BoQ rates will be applied. • **Determining Rates for Unlisted Work**: If no comparable rates are available, UNICEF will determine fair and reasonable rates, taking into account market value, work intricacy, location, and current value of similar work. • **No Variation in Contract Price**: There will be no variation in the contract price due to changes in material costs, labor wages, or the introduction/operation of laws affecting the project. 5. **Written Orders Requirement**: No variation by the contractor is to be made without a written order from UNICEF, ensuring all additional or omitted work is appropriately authorized and valued
Qualification Requirements	**Required Qualifications for Project Management** • **Project Manager Qualifications:** • A minimum of 10 years' experience in managing similar projects, with a focus on renewable energy, Digitalization/IOT platforms and environmental sustainability within educational settings. • A degree in Mechanical or Electrical or Civil Engineering, with significant exposure to solar power technology and IOT platforms and systems. • **Portfolio and Experience Documentation:** • Detailed portfolio of past projects that parallels the scope and magnitude of the proposed work, highlighting successful implementations and outcomes. • References from previous clients or employing authorities with contact details for verification. • **Team Members:** • Comprehensive profiles of key team members, including their roles, expertise, and contributions to project success. • **Additional Compliance and Operational Details:** • Compliance with local regulations, ensuring no direct or indirect participation of government employees in the tender process. • A certificate of site visit issued by the respective school/ institution administrations is mandatory with the tender submission to confirm the tenderer's understanding of site-specific requirements. **Submission Requirements:** Tenderers must accompany their bids with detailed documentation, including team member CVs, a portfolio of previous work, operational plans for geographic coverage, and a certificate of site visit. These documents are

	crucial for UNICEF and its partners to assess the tender's technical and financial capacity for executing the proposed works successfully.

<table>
<tr><td>Project Timeline and Locations</td><td>This initiative aims to equip selected schools in Erbil, Duhok, Ninawa Governorates, including all its districts, with sustainable infrastructure solutions (refer to the attached list of schools and GPS).

Project Size
The project will be implemented in up to 10 schools, across the three governorates. The selection of schools will be based on decisions made by UNICEF and MOE/the Directorate of Education in the three governorates

Implementation and Warranty Details
• Site Handover and Implementation: The implementation timeline begins once the contractor officially receives the site from the government partner. The contractor is given a period of 120 calendar days to complete the installation and operational setup for all schools. This period includes all necessary provision, installation, and initial operation activities, emphasizing a concentrated and effective implementation phase within the specified timeframe.
• Scheduling and Coordination: It is the contractor's responsibility to draft a detailed implementation schedule for each location, considering the unique needs and operational timelines of the facilities involved. This proposed schedule requires formal approval from the administration of each school, ensuring that the project's execution harmonizes with the institutions' operational dynamics and minimizes disruption.

Warranty Period
• Warranty Coverage Initiation: The warranty period of 1 year (365 calendar days) commences following the preliminary handover of the project from the contractor to the handover committee and UNICEF.</td></tr>
<tr><td>Evaluation</td><td>1. Initial Technical Evaluation Pass/Fail approach:
<table>
<tr><td>MANDATORY REQUIREMENTS</td><td>DOCUMENTS to be submitted</td><td>SCORE</td></tr>
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</td></tr>
</table>

process and methods	Lead bidder is a legal entity regulated and licensed in Iraq	1- A copy of the certificate of incorporation (i.e. company legal registration) 2- The bidder should submit a valid contactor classification card. Note: For International companies, the bidder should submit: 1 - copy of the certificate of incorporation (i.e. company legal registration) 2- Certificate verifying legal status/capacity in Iraq.	Pass / Fail

	TAX Clearance	Bidder to provide tax clearance for 2024	Pass / Fail
	Bidder keeps updated and compliant financial records	The most recent **audited financial statements**, duly approved by a certified legal auditor, for the last two fiscal years: **2023 and 2024**.	Pass / Fail

Then Bid shall be evaluated based on technical and financial criteria. The ratio weight between technical and financial criteria is (60:40).

- Technical Evaluation:
- The Bid shall be technically evaluated as below:
- The minimum passing score of the technical criteria is 42 out of 60. See the criteria on annex below.
- Financial Evaluation:

- The bidder will be financially scored based on the formula below:

Bidder (A) = (Maximum score for price proposal (40 points) x Price of lowest priced proposal among technically passed bidders)/Price of proposal (A)

- The total weight of the bidder will be the cumulative of the two above formulas (Technical and Financial).

Below are the selection criteria to be used in Bid Evaluation:

No.	Criteria	Weight
	Company and organizational profile (Experience and performance)	12
(i)	Approved "similar works" for supply and installation of solar power systems, digitalization, development and management of IOT systems, Roof rainwater harvesting (and similar techniques), and water treatment and recycling techniques (separate or in one project). The approved similar projects/works to be submitted within the list supported by contact info. of the managing agency. Similar works that were successfully implemented by the bidder with the government, agencies/ private sector. **8 points** for concrete evidence of completed work in the last 4 years (**3 points** for solar power systems **,2 points for** water treatment and recycling techniques, **1 point** for proven experience in developing and managing IOT systems, **2 points** for proven work in roof rainwater harvesting and any similar water conservation techniques). **4 points** for previous experience in similar geographical locations The evidence shall contain the following information: **1.** Nature of the works previously executed. **2.** Employing authorities and supervising engineers. **3.** Value of various contracts. **4.** Locations of implemented works. **5.** Dates when they were implemented. **6.** Certificate of completion of works. **7.** Any other information the bidders may present as evidence for his/her capability.	12
(ii)	Proposed work plan and approach	42
	4 points for Proposed work plan (Progress chart) **2 points** for approach of implementation of the tasks as per the TOR and BOQ and the suggested period.	6
	Catalogues submission of the required items (Solar panels, Inverter, battery, Smart flow meters, pumps, filters etc.) be provided (datasheet), Manufacture warranty: - **12 points** for the datasheet (**3 points for the solar panels, 4 points for the inverter, 3 for**	14

	the batteries, 1 point for the filters and smart flow meters and 1 point for the pumps). - **2 points** for the manufacture warranty (**1 point** for the solar components and **1 point** for the greywater recycling system components).	
	Site visits, at least visit one school at each governorate. **2 points / Governorate.** **A verification document signed/stamped by the school and/or the directorate of education shall be provided.**	6
	Submission of risks mitigation plan for this project. (Quality Control Plan, safety plan…etc.) Detailed plan/s with a clear mitigation measure for each risk type	3
	Suggested typical design of the solar power system, its clarity and simplicity, way of presentation, drawings, and layout. • **4 points** for the technical solution that will provide the required performance for the solar system (20Amp, 40Amp) along with the **exact design calculations and verifications.** • **4 points for structural design** • **2 for the Roof rainwater harvesting design and layout** • **3 points for drawings (1 point for each project component).**	13
(vi)	Company Key Staff	6
	List of specialized technical staff that will manage and track supply and installation process, CVs to be shared. **2 points for the Organogram 4 points for submission of CVs** (project manager, engineers, and technicians with relevant experience), along with a copy of the employment contract.	6
	Total	60

Administrative issues	For site visits please coordinate with Eng. Khozga Ahmed/WASH officer, (phone: 07833352587, Email: khahmed@unicef.org)
Administrative Compliance	To ensure the highest standards of project execution and oversight, bidders must demonstrate comprehensive capability, both technically and financially. UNICEF requires the submission of a detailed evidence letter alongside the tender, outlining the bidder's capacity to undertake the proposed works effectively. **Bidder Qualifications and Evidence of Capability** Bidders shall include in their tender: • **Detailed Evidence of Past Work**: Description of previously executed projects, including the nature of the works, authorities involved, supervising engineers, contract values, locations, implementation dates, and any other pertinent details that demonstrate capability. • **Professional Team**: Information on the engineers and technicians designated for the project, showcasing their experience and qualifications through CVs. • **Work Plan and Reporting**: A detailed work plan (Bar Chart) must be submitted to the relevant school administrations, institution management, and UNICEF within 5 days from the contract signing. Periodic progress reports will be required as determined by supervising engineers. **Project Execution and Compliance** • **Quality Assurance**: Supervising committees will mandate tests to verify the quality of materials and workmanship, adhering strictly to Iraqi standards for testing frequencies, types, methodologies, and sample quantities. Only materials and workmanship that have passed these comprehensive verifications will be accepted.

	Financial Transactions and Pricing: All Bill of Quantities (BoQ) items must be priced in IQD for Iraqi companies while for international bidders United States Dollars (USD) to standardize financial transactions and facilitate clear budget management throughout the project lifecycle. **Completion** Upon project completion: • **Maintenance and Training**: Execution of maintenance works and training for local staff as per contract terms. • **Final Handover**: Submission of a final handover certificate post-maintenance, endorsed by school/ Institution administration and confirming satisfactory project execution and maintenance.
Project Management	**Project Management and Coordination** • **UNICEF Supervision**: UNICEF provides overarching supervision to ensure the project aligns with specific goals and quality standards. • **Local Oversight**: Representatives and/or official committees from the government partner, including school/ institutions, offer day-to-day oversight, ensuring quality and adherence to project objectives. • **Project Manager Role**: The contractor appoints a project manager responsible for: • Daily management of project implementation. • Liaising between UNICEF, the government partner, and the project team. • Ensuring all project activities comply with specifications and contractual terms. **Coordination, Approval, and Accountability**: • The project manager coordinates closely with all involved parties. • Seeks and obtains necessary approvals for project milestones and deliverables from school administrations, DOEs.

- Adopts a structured approach to ensure accountability, effective communication, and the successful completion of the project, in line with UNICEF's objectives and local requirements. Top of Form

Payment Schedule

DELIVERABLE ONE

#	Governorate	District	School Name	Payment Modality
1	Ninawa	Sinjar- Snoni	Ataa Al-Rahman Primary	90% payment upon full completion of this delivery and 10% after 12 months of defect liability/Warranty period
2	Ninawa	Sinjar- Snoni	Tamim Primary	
3	Ninawa	Sinjar- Snoni	Al-Andalus Primary	

DELIVERABLE TWO

#	Governorate	District	School Name	Payment Modality
4	Duhok	Duhok-Sumel	Avand Basic	90% payment upon full completion of this delivery and 10% after 12 months of defect liability/Warranty period
5	Duhok	Duhok-Sumel	Hafid Basic	

DELIVERABLE THREE

#	Governorate	District	School Name	Payment Modality
6	Erbil	Koya	Belan Basic	90% payment upon full completion of this delivery and 10% after 12 months of defect liability/Warranty period
7	Erbil	Koya	Wan Basic	
8	Erbil	Koya	Dr. Omar Basic	
9	Erbil	Koya	Kurdistan Basic	
10	Erbil	Koya	Sarkalaki Bnarati	

Bank Warranty Letter Requirement

Prior to the preliminary handover of the first school, the Contractor shall submit to UNICEF a Bank Warranty Letter equivalent to ten percent (10%) of the total contract value for the entire project. The Bank Warranty Letter shall serve as a financial guarantee covering the warranty/defects liability period and shall remain valid for one (1) year following the preliminary handover of the final school under the project.

Payment Processing Based on Completed Deliverables

Subject to the submission of the Bank Warranty Letter and the successful preliminary

	handover of each completed school—duly certified by the Government counterpart and the UNICEF Handover Committee—UNICEF shall process payment to the Contractor for the respective school. Such payment shall be made upon confirmation of the physical completion of works at the relevant site, in accordance with the approved contract and agreed deliverables. Return of the Bank Warranty Letter Upon expiry of the one-year warranty/defects liability period following the handover of the final school, and provided that all contractual obligations have been satisfactorily fulfilled and the Final Handover Certificate for the entire project has been issued, UNICEF shall return the Bank Warranty Letter to the Contractor, thereby concluding the financial guarantee obligations under the Contract.
Other information/ Documents	- List of schools at each governorate - Bill of quantities (BOQ)

Prepared By:	Reviewed by:	Cleared by:	Endorsed by:	Approved by:
Khozga Ahmed	Zainb Al-Aghidi	Ahmed Tahir	Ali Auob	
WASH Officer	WASH Officer	OIC/ Chief of Erbil field office	Chief of WASH	OIC/Deputy Representative, programme
14-04-2026	14 April, 2026	14 April 2026	15 April 2026	

List of schools:

#	Governorate	District	School name
1	Ninawa	Sinjar- Snoni	Ataa Al-Rahman Primary
2	Ninawa	Sinjar- Snoni	Tamim Primary
3	Ninawa	Sinjar- Snoni	Al-Andalus Primary
Del 1			
4	Duhok	Duhok-Sumel	Avand Basic
5	Duhok	Duhok-Sumel	Hafid Basic
Del 2			
6	Erbil	Koya	Belan Basic
7	Erbil	Koya	Wan Basic
8	Erbil	Koya	Dr. Omar Basic
9	Erbil	Koya	Kurdistan Basic
10	Erbil	Koya	Sarkalaki Bnarati