Terms of Reference
Solar Photovoltaics water pumping for irrigation Supply and Installation for the ACCISI-GEM Project in Ghar El Melh
"Adapting to Climate Change Impacts through Smart Irrigation in Ghar El Melh wetland area, Tunisia"

Implemented by the Global Water Partnership-Mediterranean (GWP-Med)
Funded by the Maltese ministry for Foreign and European Affairs and Trade (MFET)

1. Context of the project

The project "Adapting to Climate Change Impacts through Smart Irrigation in Ghar El Melh wetland area, Tunisia" (ACCISI-GEM) is a practical demonstration of the Water-Energy-Food-Ecosystems (WEFE) Nexus approach in a coastal wetland in Tunisia. It is implemented by GWP-Med and co-funded by the Maltese Ministry for Foreign and European Affairs and Trade (MFET) and the GEF UNEP MedProgramme, within Child project 2.2 "Mediterranean Coastal Zones: Managing the Water-Energy-Food and Ecosystems Nexus" and particularly its Component 3.1.3.: Testing of novel applications and assessment of their replication potential and feasibility.

In particular, this demonstration activity represents a unique initiative that implements a holistic, multi-dimensional, innovative, community-based, gender-sensitive, and partnership-focused approach to coastal conservation agriculture using a WEFE Nexus lens. A key aspect relates to the experimentation of a novel technology for Tunisia, namely an Information and Communication Technologies (ICT)-based smart irrigation system for farming communities in the targeted area, that utilises sensors and data analytics to monitor soil and crop conditions, and water requirements in real time, enabling farmers to optimise the use of available water resources, even in water-scarce environments. Smart irrigation system management can improve crop yields while reducing water consumption and, when supported by renewable energy sources, it can make a positive change in the interface of water, energy, food and the environment.

The project will be implemented in the Commune of Ghar El Melh, in the governorate of Bizerte, located in the northeast of Tunisia (Figure 1). The municipality covers an area of 91.64 km^2 and brings together four (4) delegations (Ghar El Melh, Bejou, Aousja, Zouaouine).

The area of Ghar El Melh is home to one of the country's most precious wetlands. The Ghar El Melh lagoon was designated as a wetland of international importance under the Ramsar Convention in 2018, while the city Ghar El Melh is one of Tunisia's cultural hotspots. Tourism, farming, and fishing are some of the most important economic activities. However, the area's ecological and cultural treasures are facing several pressures having a direct impact on local society's well-being and economic prosperity. In particular, the ecological health of the lagoon

and the related fishing activities are threatened due to the change in the hydrodynamics and water balance as well as the deterioration of water quality and the excessive use of water. Expansion of agricultural land can lead to the loss of natural habitats, a threat to the ecosystem and its associated biodiversity.

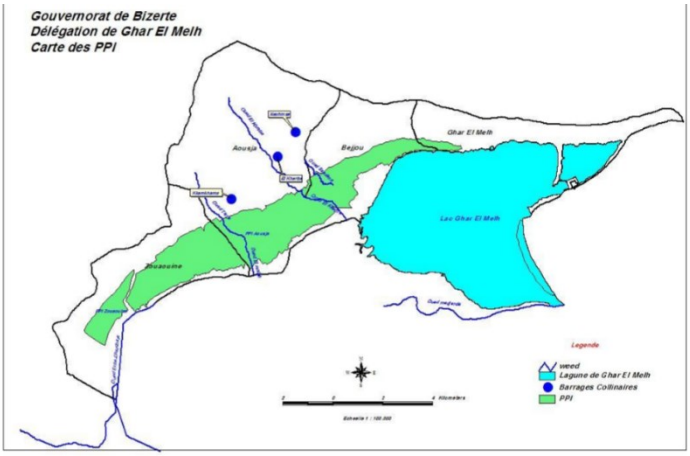

Figure 1. Location of Ghar El Melh area

2. General background of the activity

The Project provides operational decision support to a group of farmers in the area of Ghar El Melh using **Information and communication technology in agriculture** (**ICT in agriculture**) with the objective of optimising the use of irrigation water and energy use. The **ICT solution for Energy and Water Conservation in Agriculture** consists of monitoring various parameters of energy and water consumption at farm level, such as energy consumption for water pumping with an energy meter soil water profile with soil moisture probes, field/plot irrigation water management with pulse water flowmeter and solenoid valve as well as meteorological data (solar radiation, air humidity and air temperature, wind speed and precipitation) through a weather station.

The installation of this ICT **solution for Energy and Water Conservation in Agriculture** aims above all to achieve savings relating to the use of water and energy for irrigation given the strategic importance of these resources and the financial and biological benefits of a poor estimation of irrigation and related energy needs. The system can also increase crop production and water productivity as well as energy productivity in the plots.

The installation of a solar photovoltaic system in some farms aims to reduce energy consumption specifically for water pumping used in irrigation. By harnessing solar energy through photovoltaic panels, with the aim to decrease reliance on traditional energy sources such as electricity for powering water pumps. In addition, the installation of the monitoring system will enable the measurement and the continuous monitoring of the produced energy consumption.

While the installation of a piezometer will enable the measuring of groundwater levels and quality and the continuous monitoring of water and salinity levels and contribute to the conservation efforts of Ghar El Melh groundwater ecosystems made by National, Regional and Local Authorities.

All collected data will be processed using appropriate hardware and software and transformed into messages and recommendations on sustainable irrigation, transmitted to farmers through a platform.

The ICT solutions for Energy and Water Conservation in Agriculture will therefore be composed of:

- A weather station to measure the following parameters: solar radiation, air temperature, air relative humidity, wind speed and precipitation with a system for recording and teletransmitting sensors measurements
- Sensors / probes for measuring soil moisture and soil temperature and salinity profiles. These measurements of soil moisture, temperature and salinity must be done at different depths with a system for recording and teletransmitting sensors measurements

- Pulse water flowmeters and solenoid valves for irrigation management with a system for recording and teletransmitting sensors measurements
- A photovoltaic power system for pumping irrigation water
- Wireless energy meter for recording and teletransmitting energy consumption under photovoltaic electric power as well as under conventional electric power system.
- Sensors for monitoring water level and quality with a system for recording and teletransmitting sensors measurements in phreatic and deep aquifers.
- A real-time data transmission system (Gateway) with recording of data;
- IoT Platform and adapted Gateways: All installed sensors transmit periodically their values via the gateways to a platform for reading, viewing, downloading, configuring data upload, etc. and report with 2 years connectivity. It must be designed to support all the sensors that will be installed as part of the project (see ToRs Piezometers & Irrigation System).

Selection of farmers, plots

The selection of farmers/plots that will benefit from the installation of the **ICT solutions for Energy and Water Conservation in Agriculture** will be the responsibility and ensured by the project team (GWP-Med and INAT team) in collaboration with the local, regional and national authorities. The selection will take into account several parameters such as an authorized private water source (well), the deep of the water table (Phreatic aquifer or deep aquifer), distribution of plots in the field, type of crops, type of soil, irrigation techniques and the representativeness of collected meteorological data (solar radiation, air humidity and air temperature, wind speed and precipitation).

Notes:

1. Data concerning farmers, agricultural areas, crops grown, land use, etc.: will be provided by the Project team.
2. The total number of beneficiary farmers for the photovoltaic energy system will be two (02). The photovoltaic energy system for pumping irrigation water will be installed in two farms only: one whose pumping comes from the phreatic aquifer and the other whose pumping comes from the deep aquifer.
3. The Wireless energy meter for recording and teletransmitting energy consumption will be installed in five (05) farms: two (02) under photovoltaic electric power system and three (03) under conventional electric power system.
4. The Wireless energy meter will be integrated in an IoT Platform (see ToRs Piezometers & Irrigation System).
5. The local authorities and farmers will provide the necessary permits or approval for the installation of the equipment.
6. All the tasks described above will be done in close collaboration with the project team (INAT & GWP-Med) as well as local, regional and national authorities and under the supervision of the GWP-Med Coordinator.

7. Field visits for equipment installation in Ghar El Melh will be planned in advance in coordination with the project team.

3. Description of the assignment: Supplying and installation of the equipment

In this context, the Global Water Partnership - Mediterranean (GWP-Med) is seeking the service of a provider to commission and install a solar photovoltaic water pumping system for irrigation, incorporating an automated monitoring and accounting system for energy consumption at the pumping station. This system will be integrated into the proposed ICT solutions for Energy and Water Conservation in Agriculture. The installation will take place in two farms within the Private Irrigated Perimeter in Ghar El Melh, where personal pumping is permitted by local, regional, and national authorities.

Installation and set of equipment and service is required. If the service provider is not based in Tunisia or have a representative in Tunisia, s/he should partner with local company for the installation of equipment in Ghar El Melh in Tunisia. The local partner to undertake the installation, set up and technical support locally in Tunisia should be indicated in the quotation submitted.

The specific area of installation will be shown to the applicants during the scheduled site visits.

❖ Technical specifications

Power range of installed pumps in Ghar El Melh region :

- A photovoltaic system for a pump power of 3.0 to 5.0 horsepower - 380V
- A photovoltaic system for a pump power of 7.5 to 10.0 horsepower - 380V

Components of the solar photovoltaic water pumping system

Each photovoltaic system will include:

- A photovoltaic generator: made up of several connected photovoltaic modules.
- A support frame for the solar panels
- DC wiring (cables, connectors, junction boxes, protective sheath, warning mesh),
- AC wiring (mounting accessories)
- Adequate DC-rated protection cabinet (Lightning arrester, protection and cut-off devices, etc.)
- Control and protection cabinet alternating current part (cutting equipment, protection, din rail, cable passage ducts, etc)
- A DC/AC inverter suitable for the power of the installed pump.
- Earthing system/grounding system (circuit grounded by single-pole copper cable (earth connection made up of 3 copper stakes with all fixing accessories).


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Equipment Specifications:

Photovoltaic modules

Characteristics			Required Value	Proposed Value
General				
	Brand / Model =	=	To be specified	
	Country of manufacture	=	To be specified	
	Profile	=	Industrial product ready to install	
	Power*	≥	To be specified after farm selection and field visit	
	Number of modules*	=	To be specified after farm selection and field visit	
	Dimension L x P x H – mm *	=	To be specified	
Module specifications				
	Unit Power (Pmax)	≥	**** W	
	Voltage at Pmax (Vmp)	≥	*** v	
	Current at Pmax (Imp)	≥	*** A	
	Open circuit voltage (Voc)	≥	** V	
	Short circuit current ≥	≥	** A	
	Maximum voltage of system	≥	**** V	
	Efficiency / Yield	>		
Resistance to climatic conditions				
	Precipitation	=	continuous heavy rain or hail (hailstones < 25 mm)	
	Maximum wind speed	=	*** km/h	
	Temperature	ϵ	[, C]	

	Humidity	∈	[0,**]	
Standards				
	Certifications*	≥	To be specified	
Fixing structure				
	Material**	=		
	Protection	=	Yes	
	Protection Layer thickness	≥	To be specified	
	Wind resistance***	≥		
	Angle of inclination*	=	To be specified through a study according to the location	
	Assembly*	=		
	Reinforcement	=	Concrete anchoring to the ground	
Guarantee				
	Duration	≥	To be specified	

Inverter

	Characteristics		Required Value	Proposed Value
	Brand / Model =	=	To be specified	
	Country of manufacture	=	To be specified	
	Profile	=	Industrial product ready to install	
Output				
	Waveform	=	Sinusoidal	
	Harmonic distortion	≤		

	Phases	=	Three-phase +N	
	Voltage	=	Hz	
	Frequency	=		
	Ground fault detection	=	Yes	
	Input overvoltage protection		Yes	
Environmental conditions				
	Temperature	≥	From C to C	
	Non-condensing humidity	≥	From 0% to %	

Layout, installation, connection, testing and training

To ensure the safety and proper functioning of the photovoltaic system, the installation must be equipped with suitable protection and cut-off devices. These devices must be sized to guarantee effective protection against electrical risks. Here are the main measures to plan:

- DC and AC wiring (cable, connectors, junction box, etc.),
- protection devices (fuses, circuit breakers, etc.),
- cutting device,
- protection of PV modules,
- earthing,
- DC and AC cabinet junction box,
- AC and DC cable protection,
- Protection against overloads and short circuits,
- Protection against overvoltage.

Type of cables: AC and DC

Cables are sized to minimize the risk of ground fault or short circuit after installation. This precaution is guaranteed by the use of single-conductor cables offering a level of insulation equivalent to class II.

Cables must have the following characteristics:

- Flame Retardant and Fire Resistant Cables,
- admissible temperature on the core of at least 90°C in steady state,
- UV stability,
- Rated cable voltage.

Voltage drop on the DC side: The connections between the most distant PV modules and the inverter must be made with double-insulated single-pole cables of sufficient cross-section to guarantee a maximum overall voltage drop of 3%.

Voltage drop on AC side : Connections between the point of delivery to the network and the inverters must be made with cables of sufficient section to guarantee a maximum overall voltage drop of 3%.

Wireless energy meter

- Three phase system to be installed in the solar photovoltaic water pumping system
- Bi-directional meter to track the two way energy ("from grid" and "to grid")
- With RS485/LoRa/GPRS/4G/WF
- With open API interface

Additional Specifications:

1. All equipment delivered must be original industrial products and ready to install.
2. The supplier should provide a guarantee for the equipment for a minimum of one year.
3. All sensors must have an operating temperature range between -20 ºC and +50 ºC.
4. Energy supply for each equipment must be done by battery or solar panel
5. The sensors / devices must be equipped with all necessary accessories for installation and operation: protective case, mat(s), support(s), an anchoring system, etc.
6. All sensor/device enclosures and accessories must be resistant to water, dust and radiations.
7. Alert system regarding sensor/devices malfunction is required.
8. Access to raw sensor data (in direct or indirect form) is required for validation of field data.
9. All wireless energy meters have to be connected and operate on the Project IOT platform (see ToR's Weather, soil and water and Piezometer). To this end, the company is requested to provide technical support to facilitate the transfer.

10. In addition to the one wireless energy meter, two flow-meters and two multi-depth soil water content, salinity and temperature sensors will be installed in each plot.
11. Within the 1 year following the contract signature, the connection of all sensors can be transferred to a Local Platform. To this end, the company is requested to provide technical support to facilitate the transfer.
12. Documentation, manual and datasheet of the technical specifications of all the proposed material is required.
13. Adequacy of the proposed material to the requested technical specifications is required.
14. If the addition of an equipment or an accessory is deemed necessary for the correct functioning of the system, the price must be indicated with the mention EXTRA.
15. Minimum of two days training session on equipment/sensor installation, configuration, and maintenance and data configurating reading, viewing, and downloading on the IoT Platform.

4. Duration of the Contract

Delivery of the requested services (supply and installation) should be completed 45 days after the contract signature, the latest 1st of September 2024.
The date of the commencement of the contract execution shall be the last signing of the contract.

5. Contract Price, Schedule of Payments and Performance Guarantee

5.1. Contract Price and Schedule of Payments

The maximum fee for this assignment is **16.000 EUR (including VAT)**. This amount includes all other costs, income taxes and any other amount payable or cost that may be required for the completion of the service.

The schedule of payments is as follows:

- 20% payment in advance upon Contract Signature and submission of performance guarantees
- 80% payment upon satisfactory completion of the works

Each payment will be issued after the quality assessment and approval of each deliverable by the Contracting Authority. Then, the awarded service provider will issue the respective invoices.

The method for measuring completed service for payment must be in accordance with the Contract.

In the event that there are delays in the execution of the contract the contractor shall be liable to pay compensation in the form of a penalty. The amount of the flat rate compensation per day of delay (penalty) shall be of 1% of the net contract value per week up to a limit of 10% of the total contract value. For the calculation of penalties, the number of days of delays shall be converted into weeks by rounding down to the nearest week.

5.2. Performance Guarantee

The successful supplier agrees to submit to the Contracting Authority two Performance Guarantees each of them accounting to 2% of the contract value.

The successful supplier shall, within 10 calendar days of the receipt of the contract, sign and date the contract and return it together with a copy of the Performance Guarantees. The copies of the Performance Guarantees forwarded to the Central Government Authority are to be endorsed by the Contracting Authority prior to submission. The successful participant is therefore obliged to forward the original Performance Guarantees to the Contracting Authority. Any Performance Guarantees issuance expenses bear's the successful participant.

The 1st Performance Guarantee shall be released within 30 days of the completion of works to the satisfaction of the Supervising Authority and the 2nd performance Guarantee shall be released on the completion of the 12-months warranty period.
The Contracting Authority will not affect any payment to the Contractor until the Performance Guarantees have been submitted.

6. Selection Criteria (Pass/Fail)

Successful participants must provide the following:

A. Technical Offer (Annex 2):

- Be enrolled in one of the official professional or trade registries at the country of registration.
- Be licensed to perform works in Tunisia.
- Provide a signed statement of understanding the requested objective, services, and deliverables.
- Provide a signed statement certifying that the equipment is new and unused.
- Provide a Graphic Works Schedule - Program of Works in the form of a Gantt Chart.
- Provide a warranty for good operation for at least 1 year for the equipment which is to be supplied and installed.
- Provide proof of their average annual turnover for the last three (3) fiscal years being at least equivalent to the maximum amount of this Call.
- Provide a statement that at least one certified installer will perform the requested work.

- A list of projects proving at least five (5) years in the field of smart agriculture and support for farmers with a proven experience in the installation of solar photovoltaic water pumping system for irrigation and a wireless energy consumption monitoring systems in the framework of projects.
- Provide a signed certificate or a document supporting the claim that the IOT platform is designed to support all the sensors that will be implemented as part of this project, and which are linked to climate, soil, water, and energy.
- Technical specification leaflets and brochures and calibration certificates for the Compliance of the equipment should be provided.
- Have minimum duration of operation of five (5) years. Proof to be provided by the related chamber (date of registration).

B. Financial Offer (Annex 3)

7. Awarding Criterion and Evaluation Process

Award criterion is the Most Economically Advantageous offer with criterion the lowest price for the offers satisfying the selection criteria.

Submission of Offers Please refer to the Call for Offers Document for the proper submission of the Technical and Financial Offer.

8. Monitoring and progress Control

Ms. Sondos Njoumi, Programme Officer at GWP-Med, will be providing oversight and guidance from the side of the Project Team. Services will be rendered and will be considered completed upon approval of the deliverables by the Project Coordinators and the GWP-Med Executive Secretary Mr. Vangelis Constantianos.