Terms of Reference
Smart Irrigation System 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 and energy resources, even in water and energy-scarce environments. Smart energy and water solutions for irrigation 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.

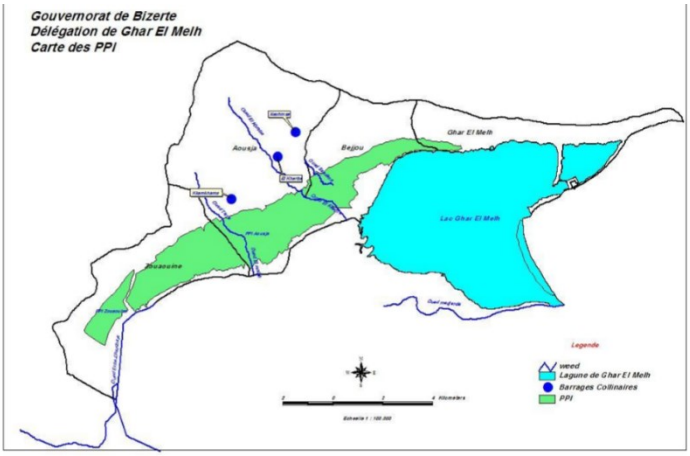

Figure 1. Location of Ghar El Melh area

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 & Photovoltaic 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:

- Data concerning farmers, agricultural areas, crops grown, land use, etc.: will be provided by the Project team;
- The total number of beneficiary farmers/plots will be five (05). 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.
- The sensors/probes will be installed in different farms. Brochures/Data Sheets of the different components of the ICT System must specify the operation conditions and any field constraints that can affect the precision/functioning of the system.
- The IoT Platform with adapted Gateways will be 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 (see ToRs Piezometers & Photovoltaic System).
- 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.

- 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) seeks the service of a service provider for commissioning and installation of the smart irrigation system**.** The system will be installed in five (05) farms located in the Private Irrigated Perimeter where personal pumping is allowed by local, regional and national authorities in Ghar El Melh.

The ICT solutions for Energy and Water Conservation in Agriculture will therefore be composed of (as described in details below)

- 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.
- Eight 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.
- Eight Pulse water flowmeters for irrigation management with a system for recording and teletransmitting sensors measurements
- An IoT Platform with adapted Gateways : All installed sensors transmit periodically their values via gateways to a platform for reading, viewing, downloading, configuring data upload, etc. and report with 2 years connectivity.
- The IOT platform must be 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 (see ToRs Piezometers & Photovoltaic System).
- The IOT platform must be designed to be accessible to different users (administrative teams, project partners, farmers) via a web console with different levels of accessibility (access to all or part of the data collected). It must also be able to integrate APIs that allow it to connect to third-party applications.

This ICT System **for Energy and Water Conservation in Agriculture** should make it possible to collect the necessary measures and once instructions to farmers for irrigation optimization are elaborated by the project team (using WEAP-MABIA Module), to convey these instructions to farmers.
The ICT system includes the IOT platform which will allow to:

- Receive the various measurements which will be transmitted by the weather station, the soil moisture probes, as well as by the pulse water flowmeter and Solenoid valve for irrigation management, energy and and water consumption at farm level as well as water level and quality in groundwater.

- Data storage, processing and monitoring of all collected data.
- Access to data by multi-users (i.e. project team, project partners, farmers, etc.)

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.

Table 1. Technical specifications

Item	Technical specification	Quantity
Weather station		**1**
- Air Temperature sensor	Measuring range - 20 to 60 °C Accuracy: < 0.5 °C	1
- Air Relative Humidity sensor	Measuring range Accuracy : 5%	1
- Solar radiation sensor	Measuring range 0 .to 1500 W/m² spectral range 350 to 2 500 nm Accuracy : 5%	1
- Wind speed sensor	Measuring range 0 .to 40 m/s Accuracy : 5%	1
- Rainfall sensor	Funnel Area : ≥ 200 cm^2 Accuracy : 5% With protection from bird	1
- Accessories	This station must be equipped with mat(s),	1

	anchoring system and all accessories for fixing the various sensors and the power system.	
Soil moisture, temperature and salinity multilayers probe		**8**
	Measuring range : 0 – 0.80 V_{water}/V_{soil} Minimum 9 depth : 0 to 60 cm Accuracy : 0.03	4
	Measuring range : 0 – 0.80 V_{water}/V_{soil} Minimum 9 depth : 0 to 90 cm Accuracy : 0.03	4
Pulse water flowmeter		**4**
	Diameter range : DN40 to DN 50 Measuring range 0 to 25 m^3/h (nominal) Operating Pressure: 0.5 - 15 Bar Accuracy : 5%	4
IoT Platform and adapted Gateways (for reading, viewing, downloading, configuring data upload, etc.)		**1**
-	All fields Sensor data (sensors Network) to be synchronized with the IoT platform Fields station/Sensors configuration Maps & Geolocation	1

	Services Data Processing & Alerting Dashboards & Reports Open API for Easy Integration	

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 sensors that will be installed by the project and which are linked to climate, soil, water and energy (see ToRs Piezometers & Photovoltaic System) have to be connected and operate on the IoT platform with a connectivity of 2 years.
10. The IoT platform must be a centralized system used to control all the connected sensors. This platform collects data, mainly from IoT sensors, then organizes and secures their transmission to the information system (IS). Among its main functions are : monitoring the communication status of sensors and their battery level, detecting possible cyberattacks, managing large quantities of data from various sources, monitoring data consumption, remote firmware updating and automatic registration of new equipment/sensors. The IoT platform can also operate locally.
    On the interface side, the IoT platform must be accessible to different users (administrative teams, project partners, farmers) via a web console with different levels of accessibility (access to all or part of the data collected). It must also be able to integrate APIs that allow it to connect to third-party applications.
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. In each plot, two flow-meters and two multi-depth soil water content, salinity and temperature sensors and one wireless energy meter will be installed.
13. Documentation, manual and datasheet of the technical specifications of all the proposed material is required.
14. Adequacy of the proposed material to the requested technical specifications is required.

15. 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.
16. 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 **26.000 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 work.

  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 Contracting 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 irrigation systems and support for farmers with a proven experience in the installation of smart irrigation systems.
- 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.