

**Smart microgrids as a solution for  
agriculture farms electrification**

# **MGFARM**

**Start 01/04/2022 - End 31/03/2025**

**Project coordinator:**

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**France**



# **LEAP-RE**

Long-Term Joint EU-AU Research  
and Innovation Partnership on Renewable Energy

## **Pillar-1 project**



## **MG-FARM**



The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

## Consortium

### Project coordinators:

- Lotfi BAGHLI, Serge PIERFEDERICI,  
Université de Lorraine, **France**

### Project partners:

- Université de Tlemcen, and CDER-UDES  
(**Algeria**),

- IECORP SA, and Université de Lorraine  
(**France**),

- TUB-WIP (TU Berlin), TUB-EET (TU  
Berlin), and MicroEnergy International  
GmbH (**Germany**),

- Ecole Nationale des Sciences Appliquées  
d'Oujda, Green Energy Park, and  
International University of Rabat (**Morocco**)

## Aim of the project

Development of smart microgrids based on Renewable Energy System (RES) to support the sustainable development of energy, water and agriculture sectors.

Based on the load profile and storage strategies of modern and sustainable agricultural practices, the system serves typical requirements such as pumping, irrigating, and cooling.

## Relevance vs MARs

The installed Digitized RE Microgrid & Smart Storage Systems will have a measurable impact on **MAR 1** by contributing to the development of a data-based research and education framework for the integration of smart grids (**MAR 4**) in the MENA region. Experimented results and enhanced local capacities on how the Digitized RE Microgrid & Smart Storage Systems will enable the connected farms to increase their production, save water and energy, contributing this way to **MAR 5**.

## *Scientific and/or technical objectives*

- Design and install a TRL 6 Digitized Microgrids with Smart Storage Solutions each on demonstration farms in Algeria and Morocco and to equip them with remote data monitoring infrastructure
- Plug&Play concept of microgrids that can be connected or disconnected without intervention or changes to manual settings
- Enhance partner's skill around Digitized RE Microgrid and Smart Storage Systems
- 3 PhD in co-supervision
- Monitor and test the water and energy consumption levels, and agricultural production on the demonstration farms

## *Scientific and/or technical objectives*

- Develop a comprehensive Data Collection and Analysis Framework (DCAF)
- Conduct a baseline study on the agricultural practices and the socio-economic environment of the participating farms
- Identify and examine best agricultural practices for climate mitigation and adaptation in the region using specified methods in the DCAF
- Conduct a thorough assessment of the agricultural activities and practices of the pilot farms, including their energy and water consumption and utilise the results to model optimized energy, water, and material flow within the farms
- Model the current and the optimized agricultural processes on the farms using quantitative computer models

## *Scientific and/or technical objectives*

- Research new business opportunities arising from the use of Digitized Microgrids with Smart Storage Solutions in Farms in North Africa as well as their impact on the socio-economic environment in rural areas and develop workable market models for the farm
- Using data from the micro grid farms and the baseline study, simulate the best agricultural practices and the business opportunities
- Analyse data and outcomes and discuss findings with the relevant public and private stakeholders through series of workshops
- Partially implement the integration of the optimized model with the microgrid on the project farms. Members of the agriculture community will be involved to facilitate later dissemination and appropriation by users
- Train the farmers and the scientific staff on how to run the microgrid and the new processes

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## *Results achieved*

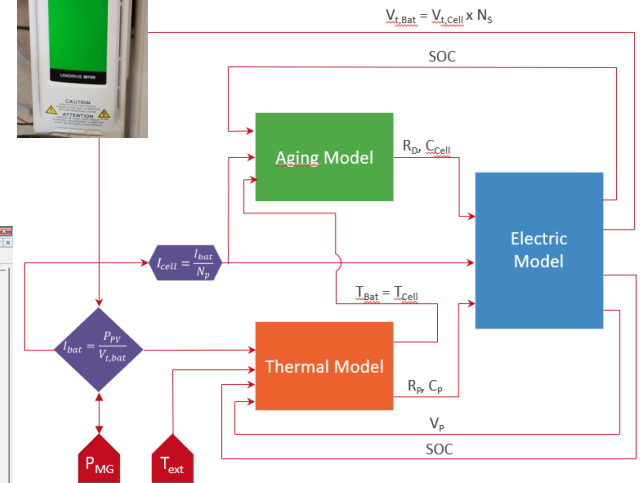
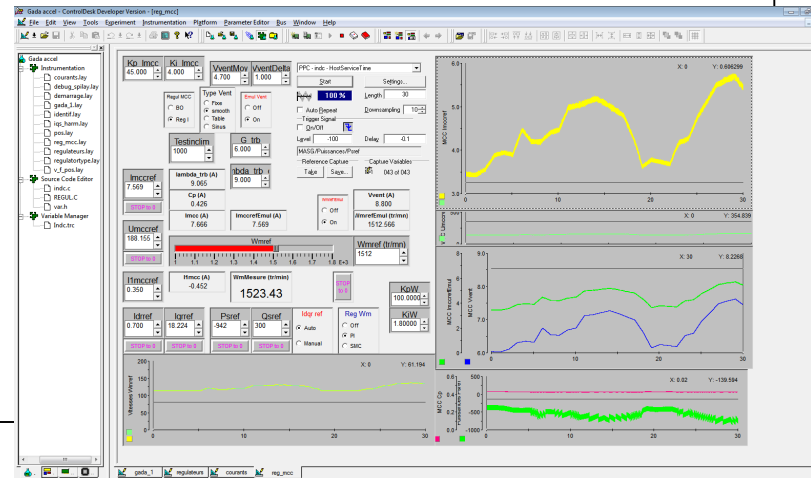
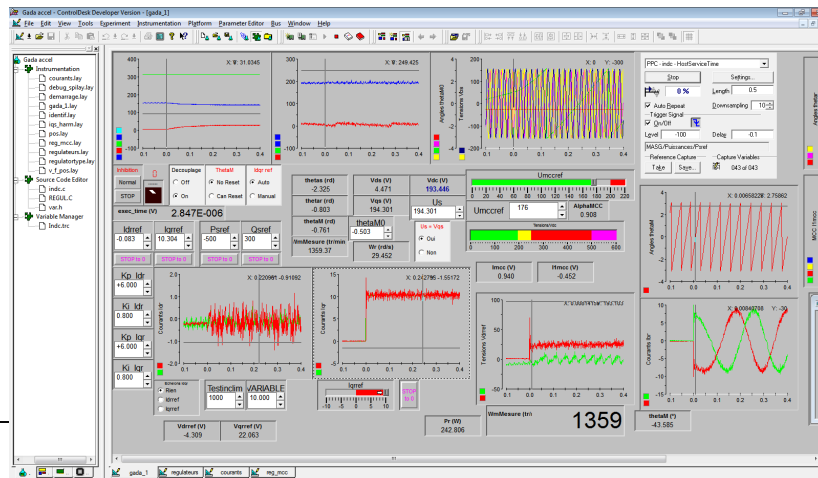
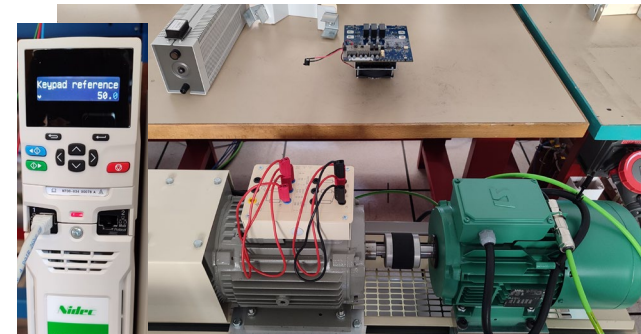
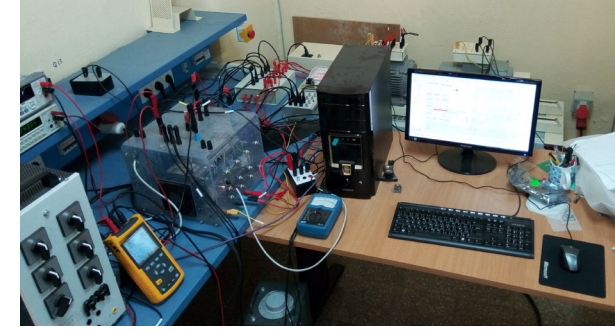
- Study existing business models with farms having partial or no RE equipment at RIMSAR, OUADIN, BLFARM (Morocco) and BELAIDOUNI (Algeria) farms
- Installation of Greenhouse, 13kW PV, geomembrane pool, water tanks and control room at UDES pilot farm (Algeria)



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## Results achieved

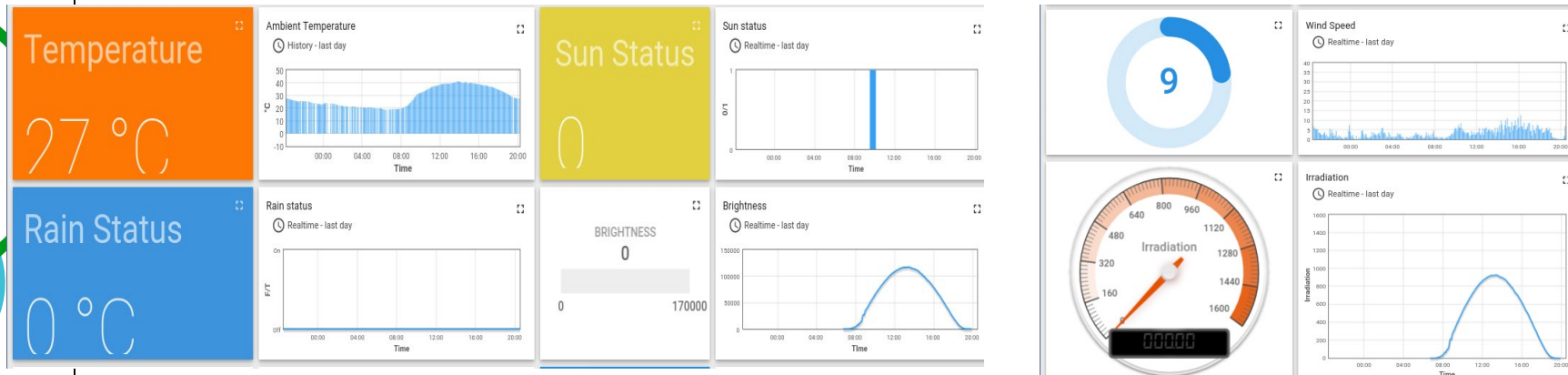
- Experimental benches at labs (TRL4) WTE at UoT (Algeria), UL (France) for PhD studies, batteries at TUB EET (Germany)
- Development of models and simulations: Li-Ion (LFP) batteries, Double Fed Induction Generator (DFIG)
- 1 journal paper, 5 conference papers, 1 submitted, 1 conference organized



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## Work in progress

- Installation of Monitoring devices at pilot farm RIMSAR (Morocco)





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## ***Results achieved***

- 1<sup>st</sup> Annual meeting at Marrakech with visits to pilot farms in Morocco and GEP facilities

## ***Difficulties***

- Procurement and installation of instruments in Algeria and Morocco
- Delays in deliverables (onsite surveys and studies)
- 2 PhD thesis out of 3 delayed (started on 01/2023 and 09/2023): Defense after the end of project



## ➤ *End of project expected results (2025)*

- Designing the prototypes, the microgrid, the battery, and the data interface
- Procurement and installation of equipment for storage and microgrid, including data monitoring equipment
- Optimization of existent installations with distributed energy between neighboring farms
- Training of data collectors, farmers and microgrid users
- Monitoring of water, energy consumption and agricultural production in the farms
- Communication and stakeholder engagement
- PhD thesis defense, publication in journal papers, participation in international conferences

➤ ***End of project expected results (2025)***

➤ ***Become of the consortium set up on this project***

Continue PhD co-supervision (North-South)

➤ ***New collaborations initiated thanks to the results of the project***

**PAUWES Pillar 2 LEAP-RE:**

- Dialogue with policymakers and other stakeholders for research uptake
- Promoting digitalization and Entrepreneurship in Africa's Energy Sector

➤ ***New collaborations planned for the future***

Future collaboration regarding residential (villages): Extension of farm microgrids concept

➤ ***New funded projects and/or funding applications:***

SWITCH project ([LEAP-RE 2023](#)), ME-ZRAATI project application (**2<sup>nd</sup> phase PRIMA 2023**)

## ***Expected outcomes in case of success of the project (2030)***

- Baseline study on the agricultural practices and the socio-economic environment of the participating farms. Data will be analysed using appropriate simulation models for the purposes of extrapolation.
- Improvement of food and energy security
- Growth of agricultural exports
- Provide a new prosumer-type energy production and consumption model at the nexus of energy-water-agriculture and digitalization in rural areas
- Proposition of new electrification schemes in rural areas

## ***Contribution of the project to AU – EU R&D partnership***

- Capacity building: Training of data collectors, farmers and microgrid users
- Research cooperation between France, Germany, Algeria and Morocco: Common work, PhDs co-supervision, development of prototypes and test benches
- Building new relationship and research partnership between AU and EU labs and universities

## ***Interest of Consortium members in participating in LEAP-RE clustering activities***

- Data Collection, analysis, modelling
- Prototyping, on site experimenting and testing
- Digitized renewable energy Microgrid & Smart Storage Systems
- MAR1, MAR4, MAR5

# THANK YOU

CONTACT US FOR MORE INFORMATION



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