Smart microgrids as a solution for agriculture farms electrification

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LEAP-RE

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

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Consortium

Project coordinators:

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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.

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Key challenges addressed by the project

1. Plug&Play concept of microgrids that can be connected or disconnected without intervention or changes to manual settings.
2. Energy management and dynamical stability are keystones of distributed microgrid systems.
3. Set-up AI, IoT and smart metering for data monitoring and blockchain technology to code the energy-packet transactions.
4. Validations of power electronics topology, its smart storage and energy management systems (TRL4 in UL and TUB).
5. On-site (Algeria, Morocco) validation under real conditions (TRL6) in farms and dwellings.

Expected results

- ***Mid-term expected results (end 2023)***

➢ Setting up the Data Collection and Analysis Framework.

➢ Analysis of the energy, water and agriculture policies and strategies in Algeria and Morocco.

➢ Modelling and designing the optimized energy, water, and material flow within the farm.

- ***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.

➢ Training of data collectors, farmers and microgrid users.

➢ Monitoring of water, energy consumption and agricultural production in the farms.

➢ Communication and stakeholder engagement.

➢ PhD co-supervision (3 PhD thesis), writing journal papers, participate in international conferences.

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

1. 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.
2. Improvement of food and energy security
3. Growth of agricultural exports
4. Provide a new prosumer-type energy production and consumption model at the nexus of energy-water-agriculture and digitalization in rural areas

Which main risks of failure during project implementation ?

1. On-site procurement can be an issue
2. PhD student recruitment failure due to ZRR (Restricted Regime Zone), Visa issue, and/or salary because of co-supervision and local policies
3. Local energy policies not allowing grid connexon and tests of the prototypes

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Contribution of the project to AU – EU R&D cooperation

- 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