Project Fact Sheet

Technische Hochschule Ingolstadt
Institute of new Energy Systems

Project Title	**Stabilizing weak grids through machine learning: empowering farmers in end-of-line communities in North Africa through artificial neural networks - SWITCH**
Keywords	Artificial intelligence, Capacity-building, Women empowerment, Open access tool, Smart grid integration, Agri-PV, Grid stabilisation, Decentralised renewable energy systems

Project Details

Project Start	01.07.2023	**Duration**	2 Years
Grant Scheme	Long-Term Joint European Union - African Union Research and Innovation Partnership on Renewable Energy (LEAP-RE)	**Project ID**	03SF0720A
Funding Authority	BMBF - Federal Ministry of Education and Research		
Project Budget	649.992,66 €		
Project Leader	Prof. Dr.-Ing. Wilfried Zörner		
Contact Person	Stefan Schneider		

Project Partners

University Ain Temouchent (UAT) and the University of Adrar (UA) in Algeria, Women Engage for a Common Future e.V. (WECF) in Germany, Aitown S.R.L. in Italy, Al Akhawayn University (AUI), the University Mohammed Premier (UMP) and the Institut National des Postes et Télécommunications (INPT) in Morocco

Context: why is this action necessary?

For several decades, the world's growing demand for electricity has been a cause for concern as it strains existing generation and transmission capacity. North Africa is one of the regions where electricity grids face critical technical and economic challenges due to rising demand from a rapidly growing population, limited growth in generation capacity, and the transition to intermittent renewable energy (RE). In particular, regional distribution grids face severe challenges in providing a reliable supply. These so-called 'weak grids' are characterised by unstable frequencies and are prone to outages. Rural farming communities are particularly affected and rely on costly, non-sustainable fuels (e.g., diesel generators) during power outages. A stabilised grid and distributed energy resources can provide reliable access to energy and mitigate the intensive use of unsustainable practices in rural communities. However, there is a lack of science-based solutions and methodologies to ensure reliable supply in such situations at the community level, considering local conditions.

What are the concrete actions that will be implemented?

The interdisciplinary team will explore how electricity supply in these "end-of-line"

communities in Morocco (MAR) and Algeria (DZ), which frequently suffer from power outages, can be improved through the integration of smart renewable energy systems, AI-driven prediction methods, and optimal Agri-PV (Agricultural Photovoltaic) solutions for local-level islanding. Additionally, the project aims to increase local revenues. SWITCH proposes a flexible approach to address the challenges faced by end-of-line communities through the temporary islanding of distributed renewable energy generators. This will be facilitated by a novel and open-access AI-driven tool that predicts power outages, solar power availability, and local demand, guiding local operators/users to operate their smart decentralized energy supply system (Agri-PV) in a manner that supports a weak grid during regular operation and autonomously supplies electricity to key consumers in case of power outages through islanding. These core technological tasks will be accompanied by capacity building in the communities, with a special focus on women, to contribute to their (economic) empowerment, as well as for decision-makers (grid operators, policymakers) to create an enabling policy/regulatory environment.

What is the expected impact of the project?

Based on the extensive training and dissemination activities, the short- to medium-term impacts of the project will include the use and promotion of the AI-driven decision support tool by the two participating grid operators and the introduction of the developed Agri-PV construction plans in the pilot communities. Both aspects are expected to contribute significantly to reducing power outages in the local rural grids. The long-term impact of SWITCH is that the tool will be used by various (private and public) grid and system operators throughout the North African region and contribute to grid stability in MAR and DZ.

In summary, SWITCH will increase energy access in rural areas and the use of RE, while providing access to affordable energy to the largest number of beneficiaries and maximising the socio-economic impact. The project will also contribute to behavioural change in energy use as well as improve economic development and promote both job creation and income-generating activities in the local context.

The project will be implemented in the province of Taounate in Morocco with the local farmers' cooperative Ariaf Kissane, and in the Bouda oasis in Algeria with the local community and a farmers' group.