VII FORUM NAZIONALE DELLE MISURE

Projet SInERT

SOLUTIONS INNOVANTES POUR L'INTÉGRATION DES ÉNERGIES RENOUVELABLES DISTRIBUÉES SUR LE RÉSEAU ÉLECTRIQUE TUNISIEN

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LAYER ELECTRONICS

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MEASUREMENT AND CONTROL ARCHITECTURE FOR RENEWABLE ENERGIES INTEGRATION ON TUNISIAN ELECTRICAL GRIDS. THE SINERT PROJECT EXPERIENCE.

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The increasing presence of distributed generation (DG) and storage systems (SS) from renewable energy sources (RES) and the transition from passive distribution networks to active smart grids require a continuous and reliable monitoring and control of power systems, to guarantee their stability and efficiency and to cope with unpredictable variations of generation and load profiles. In this framework, the SInERT project (https://www.projetsinert.com/it/) has been aimed at developing innovative solutions for RES integration on Tunisian electrical grids, based on an ad-hoc measurement and communication architecture, which entails the use of innovative devices and different technology-oriented solutions, for enabling the transition from passive to active grids, with minimal structural changes.

The SInERT project involves three research partners (Higher School of Communication of Tunis - SUP'COM, project leader; Institute of Marine Engineering of the National Research Council and University of Palermo) and two industrial partners (ACTIA Engineering Services and Layer Electronics S.r.l.). The project includes the development of two demonstrators at Elgazala technopark (Ariana, Tunisia) and Ustica island (Sicily, Italy), for sharing knowledge and experience of system operation in real grid environment. To this aim, three strategic associated partners are also involved: STEG - Société Tunisienne de l'Electricité et du Gaz; SOPES Srl- Ustica desalination plant management company; D'Anna e Bonaccorsi Srl - Ustica electrical Distribution System Operator (DSO).

SYSTEM ARCHITECTURE AND TECHNOLOGY SOLUTIONS

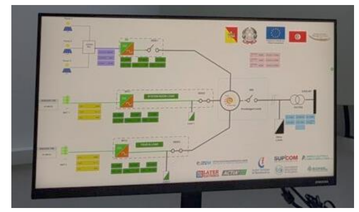
The proposed architecture for the Tunisian demonstrator is shown in Fig. 1 [1]. It is based on the experience gained on the Sicilian demonstrator of Ustica [2]. Real time measurements of relevant electrical parameters (voltage, currents, frequency, harmonics, etc.) are collected by the interface protection systems (IPSs) and power quality analyzers (PQAs); they are sent to the SCADA center for DGs and SSs control strategies implementation and their interaction with DSO remote supervision systems. The key element is the use of innovative power converters, which can change their operating mode in real time. The converters are remotely controlled both in terms of active and reactive power values exchanged with the network. The converters are interfaced with the SCADA system by means of a new Interface Electronic Device (IED), which collects information concerning converters configurations as well as environmental information concerning the production sites. Moreover, several measurement instruments are installed to measure loads in different points of the network. The sensed data are transmitted and displayed by an ad-hoc Thingsboard server and they are integrated in the SCADA system. The developed system and devices have been tested in both simulation and real environment, demonstrating their feasibility for grid monitoring and DGs and SSs control applications [3]-[4].

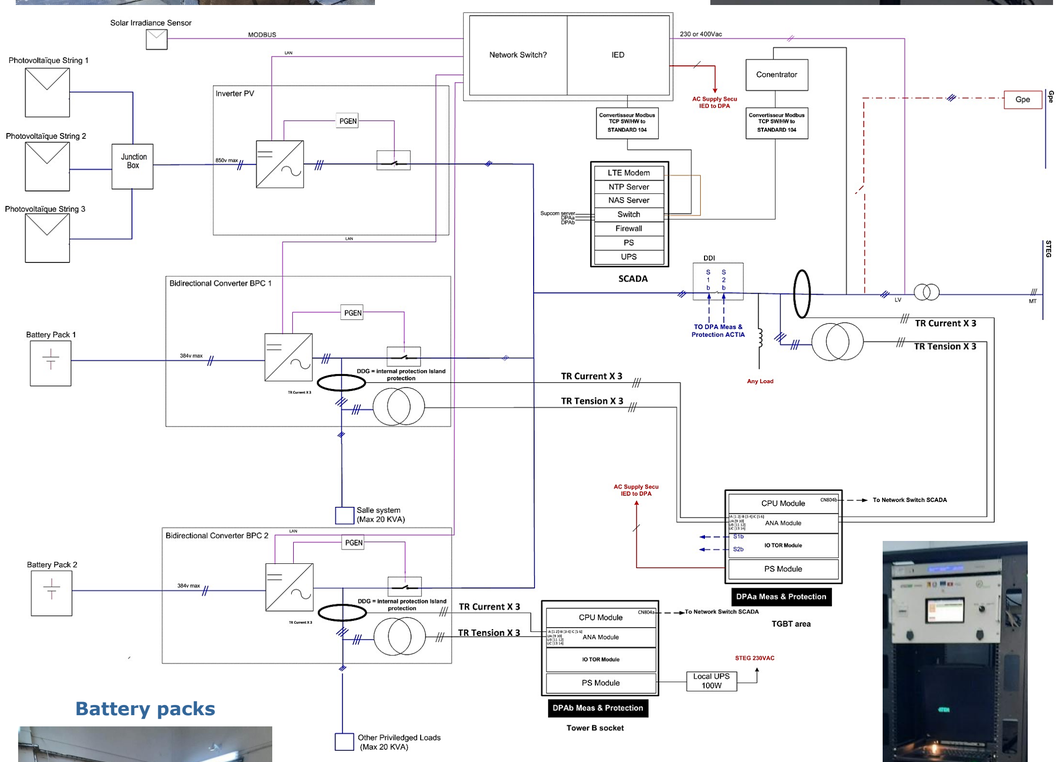
[1] *G. Artale et al, "Innovative Solutions for the Integration of Renewable Energies on Tunisian and Sicilian Electrical Grids", 2022 Workshop on Blockchain for Renewables Integration, BLORIN 2022, pp. 200-205.*

[2] *G. Caravello et al, "Impact of non-programmable distributed generation in an islanded microgrid: the case study of Ustica", MELECON 2022 - IEEE Mediterranean Electrotechnical Conf. Proc., pp. 530-535.*

[3] *Artale, G. et al, "CZT-Based Harmonic Analysis in Smart Grid Using Low-Cost Electronic Measurement Boards". Energies 2023, 16, 4063. https://doi.org/10.3390/en16104063*

[4] *A. Maalej and C. Rebai, "Sensor Data Augmentation Strategy for Load Forecasting in Smart Grid Context," 18th International Multi-Conference on Systems, Signals & Devices (SSD), 2021, pp. 979-983*





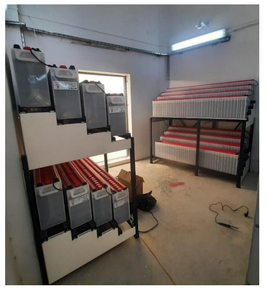


Fig. 1 Measurement and control architecture of Tunisian Demonstrator (Elgazala technopark)

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