TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	Multi-Island
Title	Experimental investigation on the performance characteristics of anti-islanding techniques in the prospect of high PV penetration level.
ERIGrid Reference	02.001
TA Call No.	2nd Call

HOST RESEARCH INFRASTRUCTURE			
Name	TECNALIA		
Country	Spain		
Start date	21 Oct	**Nº of Access days**	19
End date	20 Nov	**Nº of Stay days**	31

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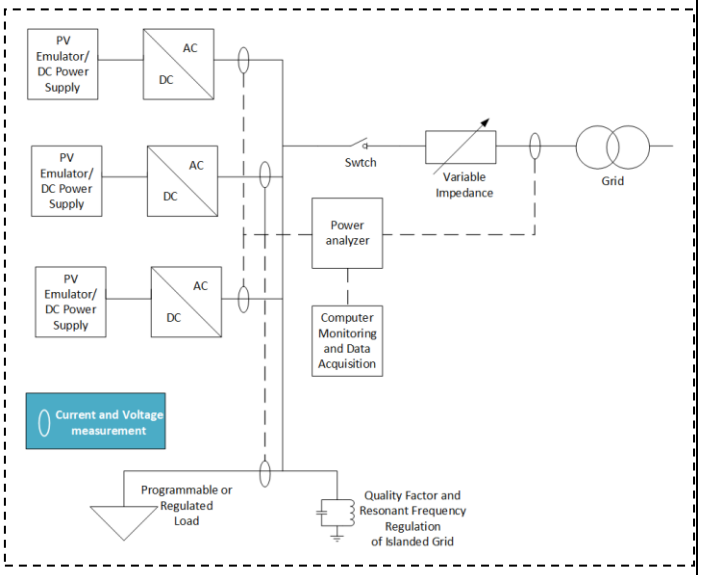
1. USER PROJECT SUMMARY (objectives, set-up, methodology, approach, motivation)

In the frame of Multi-Island project, the experimental investigation on the performance characteristics of multiple PV systems during steady state and anti-islanding techniques is examined. The experimental procedure includes different operational parameters (load characteristics, line impedance, THDs%, network voltage and frequency characteristics and transient events); using multiple commercial PV systems of different anti-islanding techniques, connected at the same Point of Common Coupling.



For the experimental procedure, we incorporated different combinations of inverters in order to capture their response, first during steady state and second during an island event during different operational parameters. In every test the load power consumption met the PV power production (load matching conditions) and the resosant frequency of the grid was set to the grid frequency. The quality factor of the grid was kept between 2 and 2.5, acourding to our capabilities of inductive and capacitive loads.

Our motivation is to understand the interactions between different PV systems for the universal implementation of our new proposed active anti-islanding detection scheme in the low voltage distribution networks.

2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

The aforementioned experimental procedure has evolved the need for a thorough study of multiple PV systems, in the prospect of anti-islanding detection under high penetration levels. It has also emerged issues about the interaction and compatibility of the different anti-islanding detection methods. In addition, the effect of the grid condition (harmonic distortion, asymmetric conditions, short-circuit level) has shown an impact on the response of the PV-inverter system. In some cases, it has presented connectivity issues, as the 1ph inverters or the micro-inverter were not able to connect to the grid under high distortion grid conditions. After our analysis we concuded the following.

The 3ph inverter does not detect the island even though the QF is less than 2.5 (although the manufacturer states that it complies with a QF=2.5 standard). A line impedance method for anti-islading detection has a quick response when it is the only inverter connected to the island. Both 1ph inverters and micro-inverter fail to sync with the grid in high or low voltage conditions when voltage distortion is introduced, especially under lower values of line impedances. The connection of multiple PV-inverters impacts on the detection time of the island. The grid impact on the ability of the inverters to connect depends on voltage level, THD and line impedance. Negative sequence seems to affect the islanding detection (as in the case of micro-inverter) as it offsets the original position of the inverter inside the detection window.

In conclusion, the interactions of the inverter should be considered, as in many cases the detection of the islading condition fails. In addition to the above, further research should be done in order to extrapolate more results between the interactions of inverter and the grid.

3. PLANNED DISSEMINATION OF RESULTS (journals, conferences, others)

The results of the project are to be published in international scientific conferences and journals, after further analysis. Furthermore, the results will be the input for forthcomming MSc and PhD theses. As an indication, the results may be published is some of the following conferences / journal series:
European Power Electronics Conference;
IET Renewable Power Generation Conference;
IEEE Power Electronics & Distributed Generation Conference;
Power Engineering-Energetika Conference;
Panhellenic Conference of Electronics;
Elsevier Renewable Energy Journal;
Energies Journal;