TRANSNATIONAL ACCESS
USER PROJECT FACT SHEET

USER PROJECT	
Acronym	**IDR**
Title	**Improved droop regulation for minimum power losses operation in islanded microgrids**
ERIGrid Reference	
TA Call No.	**3rd**

HOST RESEARCH INFRASTRUCTURE			
Name	**PRISMES Hardware-in-the-loop simulator and multi microgrid test platform**		
Country	**France**		
Start date	**06/03/2018**	**Nº of Access days**	**28**
End date	**12/04/2018**	**Nº of Stay days**	**39**

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

The objective of the proposed work is minimizing losses in the optimal power flow under frequency-constrained operation by a modified nonlinear droop control method for microgrid with moving slope. It is well known that power flow problem may provide infinite solutions if the generators do not have fixed output. Optimal power flow solves this problem by providing a unique solution for each loading condition. Such solution, when loads and lines are modelled as frequency dependent components, also comprises the operating frequency.

The objectives of the proposed work are:

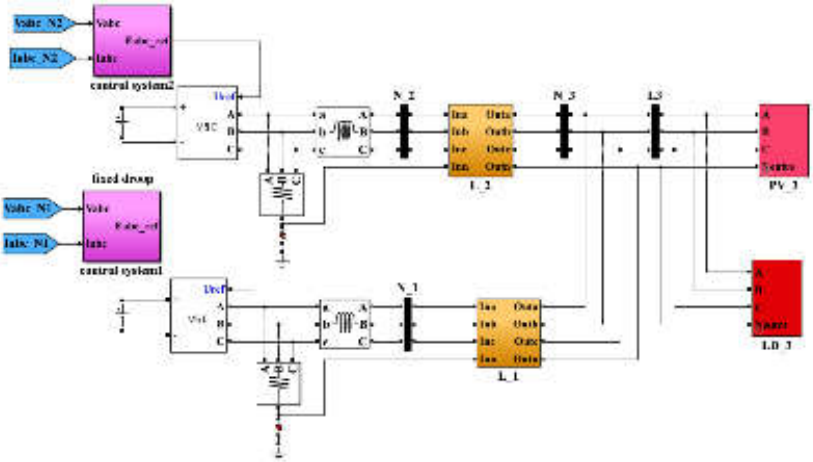
- Integrating proposed droop control loop combined with the limiters of droop coefficients K_G and frequency,
- Testing the stability of the new droop regulation when the load varies,
- Collecting data and conducting data analyses.

The expected outcomes:

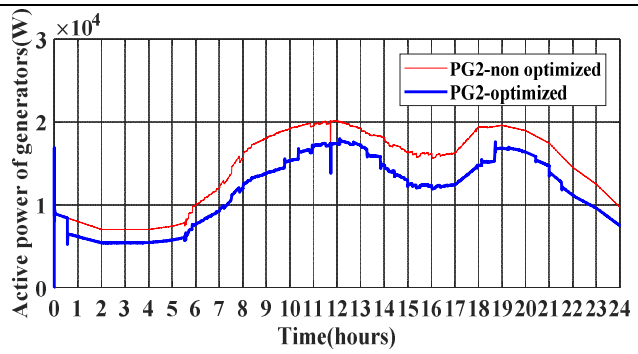
- A tested version of the new regulation method.
- Power losses reduction during operation.
- Meeting of frequency constraint, ensuring the stability of the system.

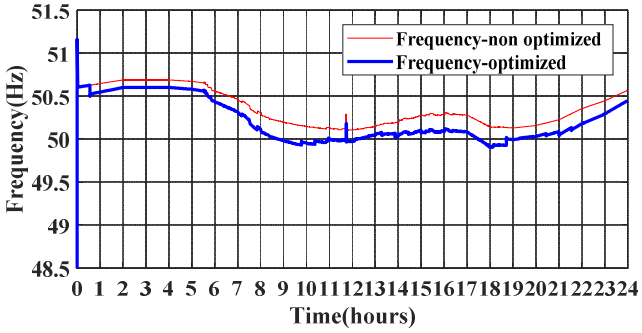
2. MAIN ACHIEVEMENTS (results, conclusions, lessons learned)

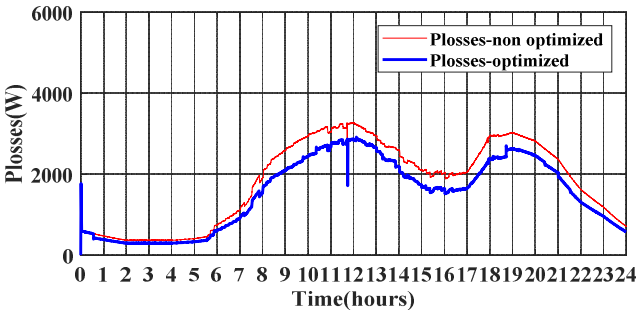
A smaller system of 3 buses is simulated in RT-lab simulator to express the advantage of this new method as well as to verify the operating properties of system.

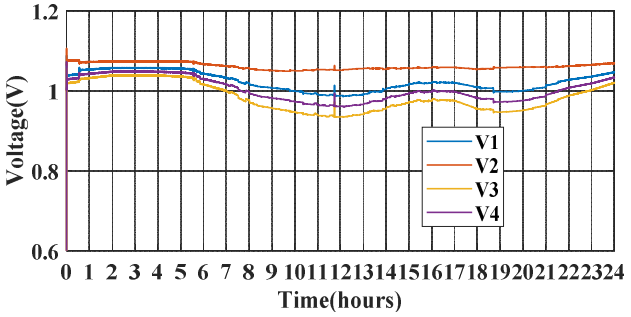


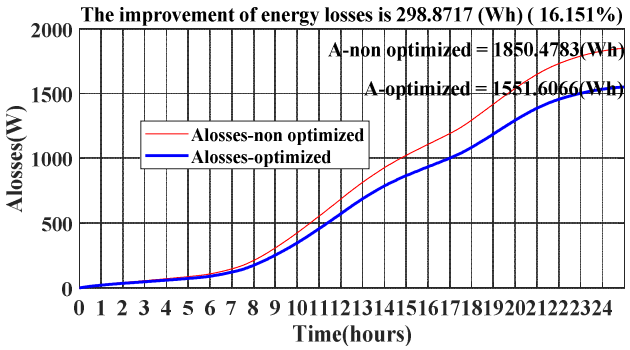
The experiment is simulated for a 4-bus system as described in the same in the Section III when the power load at bus 3 changes from 0,1 pu to 0,24 pu, power load at bus 4 is constant and equal to 0,1 pu. The experiments are also implemented for different loading conditions to assess the power sharing between generators, the variation of frequency as well as the improvement of power losses when a new regulation method is applied. Results are illustrated in figures.

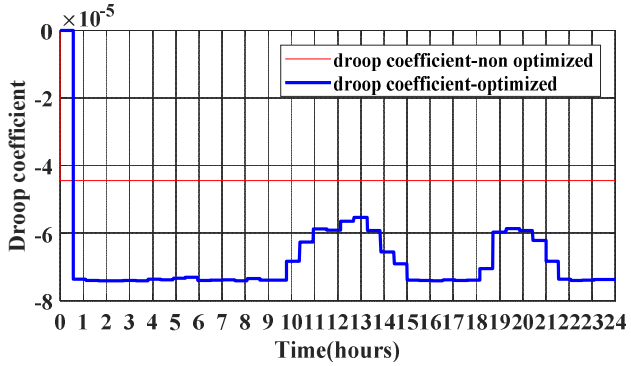












In this paper, a new droop regulation method is proposed for inverter-interfaced units in islanded microgrids. The results have been compared with conventional droop control to prove the effectiveness of the new droop control curve. The results are also simulated using RT lab simulator and to test operating characteristics of the system with hardware in the loop simulation. Further works will produce similar droop regulation curves in larger systems, also optimizing other operating features as fuel cost or operating cost. The proposed on-line procedure ensures a robust optimized operation, since no 24-hours scheduling or rolling horizon approaches are needed for tertiary regulation. In future works, as already outlined in the conclusions of part I of this paper, the consideration of storage units will provide even more flexibility and possibility to improve the operational features even more. Other works, will also consider optimized voltage adjustment in droop control.

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

IEEE Transactions on Smart Grid, Sustainable Energy, Grids and Networks - Journal - Elsevier