International Conference on Renewable Energies and Power Quality
(ICREPQ'23)
Madrid, Spain, 24 -26 May 2023

Frequency stability constrained unit commitment in isolated power system with high penetration of renewables energy sources

Dr. Lukas Sigrist
ETSI ICAI-IIT. Universidad Pontificia Comillas
Madrid, Spain

Abstract
Islands are facing considerable challenges in meeting their energy needs in a sustainable, affordable and reliable way. This is mainly due to the isolated nature and small size of island power systems and the cost of the fuel for power generation. According to local resource availability, renewable energy sources (RESs) offer an interesting solution to decrease the dependency on fossil fuels and increase island sustainability [1]. Other actions such as including energy storage devices can further increment RES penetration.

Intermittent behavior of RES affects both the stability of isolated island power systems as well as their economic operation. On the one hand, RESs allow reducing system operation costs for having lower marginal costs than conventional generation. On the other hand, the substitution of conventional generation by RESs in the dispatch may reduce system inertia and frequency control capacity, further jeopardizing frequency stability, which is already a challenge for isolated power systems. Currently, RESs do not provide reserve and inertia, but they are technically able to do so and it may be actually viable under high RES penetration scenarios [2].

Reserve requirements serve as the nexus between operation and frequency stability in isolated power systems. Nowadays, reserve requirements contemplate the size of the disturbance but they do not take into account the dynamics of the power system, which govern the stability of the system. This presentation will start with a techno-economic analysis of island power system under high RES penetration. The impact of RES providing reserve on the economic operation and frequency stability will be shown. The impact on frequency stability will lead to an operation planning approach, formulated as a unit commitment, that contemplates frequency dynamics explicitly. Both, analytical and data-driven formulations of the constraints of frequency dynamics will be presented [3].

References

[1] L. Sigrist, E. Lobato, L. Rouco, M. Gazzino, M. Cantù. Economic assessment of smart grid initiatives for island power systems. Applied Energy. Vol. 189, pp. 403 - 415, March 2017.

[2] M. Rajabdorri, L. Sigrist, E. Lobato, M.C. Prats, F.M. Echavarren. Viability of providing spinning reserves by RES in Spanish island power systems. IET Renewable Power Generation. Vol. 15, nº. 13, pp. 2878 - 2890, October 2021.
[3] M. Rajabdorri, E. Lobato, L. Sigrist. Robust frequency constrained uc using data driven logistic regression for island power systems. IET Generation Transmission & Distribution. Vol. 16, nº. 24, pp. 5069 - 5083, December 2022.

*Short biography of **Lukas Sigrist***

Lukas Sigrist received his MSc degree in Electrical and Electronics Engineering from École Polytechnique Fédérale de Lausanne (EPFL) in 2007 and his PhD degree from Universidad Pontificia Comillas in 2010. At present he is a researcher at the Instituto de Investigación Tecnológica (IIT) of Universidad Pontificia Comillas de Madrid. He is also the secretary of the council of IIT. His areas of interest are modeling, analysis, and control of electric power systems. Dr. Sigrist is a member of the IEEE, and the Treasurer of the Spanish Chapter of the Power and Energy Society of IEEE.