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Power Quality Improvement and Low Voltage Ride through Capability in Hybrid Wind-PV farms Grid-Connected Using Dynamic Voltage Restorer

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Abstract - The use of a dynamic voltage restorer (DVR) to improve power quality and low voltage ride through (LVRT) capability of a three-phase medium-voltage network connected to a hybrid distribution generation system is proposed in this project. The PV plant and the wind turbine generator (WTG) are connected to the same point of common coupling (PCC) in this system.

Key Words: Active power, DC-link Voltage DFIG, Dynamic Voltage Restorer, LVRT, Power Factor, Photovoltaic, Voltage Stability, Reactive Power.

Introduction:

In this context, most countries' energy policies tend to favor the use of renewable energies as a clean, readily available, and less expensive source of energy in order to achieve high levels of integration close to 20% by 2020.

This problem is exacerbated by the fact that wind speed estimates are less trustworthy than solar irradiance projections. Another obstacle restricting the integration of these energies is the location of renewable energy production sites, which are typically in remote places with ideal wind and surface conditions in the case of wind and solar energy, but with relatively weak transmission infrastructures.

Literature Survey:

In this context, the energy policy of most countries around the world tends towards the exploitation of renewable energies as clean, available and cheaper source of energy in order to reach high levels of integration close to twenty percent by 2020.

Similarly, if a renewable energy power plant operating at full power it suddenly disconnected due to a fault in the internal grid of the installation, the grid should remain stable and the voltage and frequency of the grid must be maintain within their admissible ranges.

Most interconnection standards today require renewable energy farms to have the ability to handle severe disturbances, commonly referred to as fall ride through (FRT) capability or, in some cases, LVRT generally means that a generator is not allowed to disconnect in case of a short term voltage dip resulting from a short-circuit in the grid.

The stochastic nature of these renewable energy sources can have an impact on the dynamic behavior of the grid and its stability during sudden and significant variations in the power delivered by one or more units of high power.

Block Diagram:

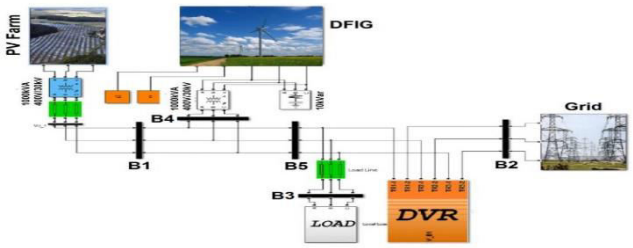

Fig. PV-WTG hybrid system with DVR and a load connected to grid

3. Conclusion:

The simulation study was carried out using MATLAB to demonstrate the effectiveness of the proposed DVR control system to improve the power quality and LVRT capability of the hybrid PV-WT power system. The system has been tested under different fault condition scenarios. The results have shown that the DVR connected to the PV-Wind hybrid system at the medium voltage grid is very effective and is able to mitigate voltage outages and short circuit failure with improved voltage regulation capabilities and flexibility in the correction of the power factor. The results of the simulation also prove that the system designed is secure since the required voltage ranges are respected correctly and the DG generators operate reliably. The main advantage of the proposed design is the rapid recovery of voltage; the power oscillations overshoot reduction, control of rotor speed and preventing the system from having a DC link overvoltage and thus increasing the stability of the power system in accordance with LVRT requirements.

Reference:

- J. Hossain and H. R. Pota, Robust Control for Grid Voltage Stability High Penetration of Renewable Energy,1st ed. Singapore: Springer, 2014, pp. 1–11.
- S. Talari, M. Shafie-Khah, G. J. Osório, J. Aghaei, and J. P. S. Catalão, ‘‘Stochastic modelling of renewable energy sources from operators’ point-of-view: A survey,’’ Renew. Sustain. Energy Rev., vol. 81, no. P2, pp. 1953–1965, Jan. 2018.
- R. Teodorescu, M. Liserre, and P. Rodríguez, Grid Converters for Photovoltaic and Wind Power Systems, 1st ed. Hoboken, NJ, USA: Wiley, 2011.
- G. R. Rey and L. M. Muneta, Electrical Generation and Distribution Systems and Power Quality Disturbances, 1st ed. Rijeka, Croatia: Intech, 2011.
- R. Li, H. Geng, and G. Yang, ‘‘Fault ride-through of renewable energy conversion systems during voltage recovery,’’ J. Mod. Power Syst. Clean Energy, vol. 4, no. 1, pp, 28–39, 2016.
- S. Kirmani, M. Jamil, and I. Akhtar, ‘‘Economic feasibility of hybrid energy generation with reduced carbon emission,’’ IET Renew. Power Gener., vol. 12, no. 8, pp. 934–942, Nov. 2018.
- S. M. Muyeen, ‘‘A combined approach of using an SDBR and a STATCOM to enhance the stability of a wind farm,’’ IEEE Syst. J., vol. 9, no. 3, pp. 922–932, Sep. 2015.
- S. Ghosh and S. Kamalasadan, ‘‘An energy function-based optimal control strategy for output stabilization of integrated DFIG-flywheel energy storage system,’’ IEEE Trans. Smart Grid, vol. 8, no. 4, pp. 1922–1931, Jul. 2017.
- G. Rashid and M. H. Ali, ‘‘Nonlinear control-based modified BFCL for LVRT capacity enhancement of DFIG-based wind farm,’’ IEEE Trans. Energy Convers., vol. 32, no. 1, pp. 284–295, Mar. 2017.
- M. K. Döşoğlu and A. B. Arsoy, ‘‘Transient modeling and analysis of a DFIG based wind farm with supercapacitor energy storage,’’ Int. J. Elect. Power Energy Syst., vol. 78, pp. 414–421, Jun. 2016.