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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.**

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

1. 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.

2. Problem Statement

The main reason behind this concept is to, change the energy policy of most countries around the world tends towards the exploitation of renewable energies as clean. There are more than one billion people still did not have access to electricity. The two major sectors consuming electricity are the residential-tertiary sector and industry, however, this consumption has a huge impact on the environment due to the emission of CO_2.

3. MTLAB Description

- MATLAB is a computer language that engineers and scientists use to study and build systems and products that change the world. The MATLAB language, a matrix-based language that allows the most natural expression of computational mathematics, is at the heart of MATLAB.
- MATLAB is a high-performance technical computing language. It combines computing, visualization, and presentation.

4. Objectives

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. Another factor that negatively impacts the power quality comes from the presence of modern power electronics technology as the output interface of power plants. R factor limiting the integration of these energies is the geographical location of the renewable energy.

1) Diagram

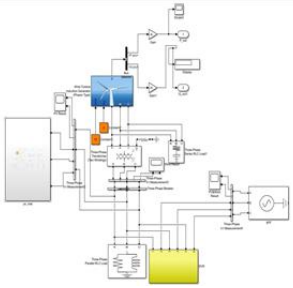

Fig. 1. Block diagram of PV solar and wind energy matlab diagram

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2) Working

- In the working of this model when Air will strike on blades of the rotor, rotor will start rotating. By the rotation of rotor Gear in the gear box will start rotating and shaft is connected to the generator then generator will produce electricity and it will give electricity to AC-DC converter (Transformer).
- In the second part PV cell sun give radiations then electricity will produce by this PV cells then it will be given to charge controller and then it will give electricity to AC-DC converter (Transformer).
- In this system, the photovoltaic (PV) plant and the wind turbine generator (WTG) are connected to the same point of common coupling (PCC) with a sensitive load. In addition, the DVR (Dynamic Voltage Restoration) based on fuzzy logic controller is connected to the same point of common coupling (PCC). Here we used DVR (Dynamic Voltage Restoration) for regulates AC voltage to provide high quality voltage to grid.

5. Conclusion and Future Scope

The simulation study was carried out using MATLAB to demonstrate the effectiveness of the proposed dynamic voltage restorer (DVR) control system to improve the power quality and low voltage ride through (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.

References

[1] 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.

[2] 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. 2, pp. 1953–1965, Jan. 2018.

[3] R. Teodorescu, M. Liserre, and P. Rodríguez, Grid Converters for Photovoltaic and Wind Power Systems, 1st ed. Hoboken, NJ, USA: Wiley, 2011.

[4] G. R. Rey and L. M. Muneta, Electrical Generation and Distribution Systems and Power Quality Disturbances, 1st ed. Rijeka, Croatia: Intech, 2011.

[5] 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.

[6] 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.

[7] 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.

[8] 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.

[9] 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.

[10] 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.