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Maximum Power Utilization On Solar With Sofc Power Generation with Its Effects Analysis in Microgrid

PG Scholar Sheetal Soni, Asst.Prof. Rahul Rathore
Department of Electrical Engineering
Shri ram Institute of Technology Jabalpur (M.P.), India

Abstract- Nowadays Renewable Energy plays a great role in power system around the world. It is a demanding task to integrate the renewable energy resources into the power grid .The integration of the renewable resources use the communication systems as the key technology, which play exceedingly important role in monitoring, operating, and protecting both renewable energy generators and power systems. This paper presents Review about the integration of renewable energy mainly focused on wind and solar to the grid.

Keywords- Communication Systems, Grid, Renewable Energy, Solar Power, Wind Power.

I. INTRODUCTION

The rapid growth of electrical power demand, increasing different types of REN sources penetration, deregulation of the power system are the main reasons of the existence and frequent updating of the grid codes. Also, the necessity for cooperation between turbine manufacturers, wind farm operators, service providers, certification bodies and engineering companies are other fundamental reasons. A grid code is a set of the technical specification which defines the necessary limitations of a generating unit for its connection to the utility. Generally, Transmission System Operator (TSO) by considering the previous experience of the power system operation and the future needs, establishes regulations for connection codes of power generation units.

These regulations are enabled in order to operate the power system in the best manner. Nowadays REN sources play a significant role in supplying the demand for the power systems and numeral papers have discussed the proper methods for operating these new generating units with the conventional energy sources, all together (EREC, 2011; Union, 2009). Several corporations and institutes have established different rules and procedures for integration of REN sources into the grid (Ardani et al., 2013; Energie und & Wasserwirtschaft, 2008; Haque, Saw, & Chowdhury, 2014; Wu & Wang, 2014).

II.RESEARCH MOTIVATION

In this paper, it reviews some communication technologies available for grid integration of renewable energy resources. Since most renewable energy sources are intermittent in nature, it is a important task to integrate a significant portion of renewable energy resources into the power grid infrastructure mainly the electricity flow takes place in one direction from the centralized plants to consumers. When compared to large power plants, a renewable energy plant is having less capacity. But as emerging resources renewable energy should be taken into account. By achieving the integration as shown in Fig.1 we can improve monitoring techniques, protection, optimization and the operation. And also two way flow of electricity can be employed.

III.LITERATURE REVIEW

MinghaoWang, Mechanism of second harmonic generation of photovoltaic grid-connected system faults and its impact on transformer protection: The short-circuit transient characteristics of photovoltaic(PV) power system are different from traditional power sources. When thegrid voltagedrops, the output current of PV will contain a high proportion of second harmonics which cannot be ignored. This paper takes a single-phase turn-toturn short-circuit fault inside the PV grid-connected transformer as an example. First, it analyzes the mechanism of single-frequency input and doublefrequency output of a three-phase gridconnectedinverterbased on a phase-locked loop (PLL), and secondly, considering the comprehensive grid-connected control strategy, the principle of current second harmonic in the minor faults is analyzed and the analytical expression of second harmonics is derived.

It is pointed out that the transient dc component will produce secondharmonic componentin the grid-connected current through control system of the inverter. This current induces a secondharmonic voltagein the impedance, and as a disturbance term it generates a newharmonic currentthrough the control link. Superimposed second harmonic currents in two scenarios may threaten the reliability of transformer differential protection. Finally, the correctness of the theoretical analysis is verified by simulation based on MATLAB/Simulink [1].

XianhaiMeng, Local PEBI grid generation method for reverse faults: The 2.5D PEBI (PErpendicular BIsector)

grid, which is the projection or extrusion of the 2D PEBI gird, has advantages on practicalreservoir modeling. However, to appropriately handle thegeological features, especially the reverse faults in reservoir, remains a difficult problem. To address this issue, we propose a local PEBIgrid generationmethod in this paper. By constructing the Voronoi cell of a seed based on the search of its neighboring seeds in a background grid, our method is demonstrated to be efficient and adaptable to reverse fault constraints. In addition, the vertical and horizontal well constraints are also tackled and the cell quality is improved through the CentroidalVoronoi Tessellations(CVT) principle. The results demonstrated that our method enables the formation of high-quality grids and guarantees the conformity to the geological features in reservoirs [2].

Rashad M.Kamel, Effect of wind generation system types on Micro-Grid (MG) fault performance during both standalone and grid connected modes: Recently, there are three wind generation (WG) system types. The first type is called Fixed Speed Wind Generation (FSWG) system, which employs squirrel cage induction generators. Double Fed Induction Generator (DFIG) is utilized in the second type. The third type is called Full Converter Wind Generation (FCWG) system, which is interfaced with MicroGrid (MG) through a back to back converter.

During fault occurrence, each WG has its performance and characteristics which are determined by the generator physical characteristics and the MG earthing system configuration. For some WG types, the fault current depends also on the control algorithm of the power converter. The main target of this paper is to investigate and estimate how the fault performance of MG during both standalone and gridconnected modes is influenced by the type of WG. It is found during standalone mode that the type of the employed WG has a dominant impact on the MG performance under fault disturbance. On the contrary, the type of the employed WG has a negligible effect on the MG fault performance during grid-connected mode. This is because the main grid contributes most of the fault current. Effects of earthing system type on MG performance are highlighted [3].

JunYao, Coordinated control of a hybrid wind farm with DFIG-based and PMSG-based wind power generation systems under asymmetrical grid faults: A non-communication-based coordinated control strategy for a hybrid wind farm withdoubly fed induction generator(DFIG)-based and direct-driven permanent magnetsynchronous generator(PMSG)based wind farms under severe asymmetrical grid faults is proposed in this paper. Firstly, the in-depth research of the severe asymmetrical fault and its impact on the operation characteristics of the DFIG and PMSG systems are investigated. Secondly, based on the operation characteristics analysis, the control objectives and priorities of the hybrid DFIG and PMSG systems are described first time during severe asymmetrical fault, respectively. In addition, the current allocation principles of each control unit in the DFIG and PMSG systems are investigated in detail according to the converter capacity and the system operation conditions. Furthermore, a coordinated control strategy for the hybrid wind farm is proposed. This strategy make full use of each wind farm's current capability, both the operation performance of the entire hybrid wind farm and the voltage quality of the power grid was greatly improved collectively. Finally, the correctness of the theoretical analysis and the effectiveness of the proposed control strategy for the hybrid wind farm with DFIG and PMSG are validated by the simulation and experimental results [4].

A.Darwish, Fault current contribution scenarios for grid-connected voltage source inverter-based distributed generation with an LCL filter: Inverterbased distributed generation (IBDG) is characterized by its negligible fault current contribution compared with synchronous generators due to its inherent nonoverload capabilities. Thus, IBDG hardly affects the fault current level; this shadows the conventional protection schemes resulting in improper system protection especially with a high penetration of IBDGs at high power levels and/or in island operation mode.

This paper presents an experimental investigation of two scenarios for IBDG fault current contribution under different fault conditions. In the first scenario, the inverter is controlled to produce zero output current or is disconnected upon fault occurrence, which is the case for most commercial grid-connected inverters. In the second scenario, the inverter contributes its rated current to the fault. The practical selection may be questionable and is affected by the fault level, employed protection scheme, and the penetration level of IBDGs. The introduction of double-loop proportional-resonant (PR) current controller is investigated using three case studies applying the previously described fault current contribution scenarios. The double-loop PR controller is found favorable when the inverter is designed to contribute its rated current to the fault. This conclusion is verified experimentally in this work [5].

Rashad M.Kamel, Employing two novel mechanical fault ride through controllers for keeping stability of fixed speed wind generation systems hosted by standalone micro-grid: This paper proposes and designs two novels Fault Ride Through (FRT) controllers for maintaining Fixed Speed Wind Generation system (FSWGs) stability during fault events. The first technique has been implemented by increasing the wind turbine blade pitch angle with maximum possible rate to reduce the mechanical extracted wind power and consequently suppress wind generation system acceleration. The second FRT technique has been verified by adapting gear ratio of wind generation system

to run far from optimummaximum power pointand help FRT process. Effectiveness of the two proposed FRT techniques has been proven by accurate simulation of the most severe disturbance conditions. Also, Results indicated that second technique gives faster response than the first one. Without employing any FRT technique, FSWGs cannot keep its stability and the standalone Micro-Grid (MG) transfers to the blackout mode. Implementation the two FRT techniques requires no additional hardware. Only, control algorithms need little modification to deal with fault event and help FRT process. This fact makes the two proposed FRT techniques are simple, practical and highly economical attractive [6].

Rashad M.Kamel, Maintaining stability of standalone Micro-Grid by employing electrical and mechanical fault ride through techniques upon fixed speed wind generation systems: This study presents two different Fault Ride Through (FRT) techniques to keep and restore stability of Fixed Speed Wind Generation system (FSWGs) installed in standalone Micro-Grid (MG). The first technique is an electrical FRT and is implemented by inserting a series resistance with the terminals of FSWGs during fault to maintain reasonable value of terminal voltage and consequently help stability restoration. The second controller is a mechanical FRT controller and is performed by change the gear ratio of wind generation systems to spill part of extracted mechanical power and consequently improving stability issue. Obtained results proved that each controller able to maintain the stability of FSWGs under the most severe disturbance conditions (400 msthree phase faultat FSWGs terminals).

The first controller is faster than the second controller in restoring FSWGs stability. Superior results and performances are obtained when the two FRT techniques are employed simultaneously. Without employing any one of the two FRT techniques, FSWGs is not able to maintain or restore its stability after fault clearing. Consequently, MG will lose one of its micro-sources and cannot keep its stability during the standalone mode, unless load shedding strategy is activated. The two proposed controllers are simple, effective, and economical attractive [7].

Y.Errami, Control of a PMSG based Wind Energy Generation System for Power Maximization and Grid Fault Conditions: The study of a Wind Energy Conversion System (WECS) based on Permanent Magnet Synchronous Generator and interconnected to the electric network is described. The effectiveness of the WECS can be greatly improved, under Grid Fault, by using an appropriate control. So, the control strategy combines Maximum Power Point Tracking (MPPT) and a pitch control scheme to maximize the generated power. Consequently, WECS can not only capture the maximum wind energy, however it can also maintain the frequency and amplitude of the output voltage. Simulation results have shown the effectiveness of the proposed control strategy for WECS based on the PMSG [8].

P.Stefanidou-Voziki, A review of fault location and classification methods in distribution grids: The evolution of the conventional power systems to smart grids has changed the way to conceive and operate them. The part of the grid evolving the most is the distribution grid where the installation of additional sensors and actuators has increased itsobservabilityand controllability. These have enabled the development of more accurate and automated processes including some critical ones such as the fault detection, isolation and restoration techniques. In this direction, unconventional methods, e.g. artificial intelligence, have been increasing in popularity over the last years. In this paper, fault location and fault classification methods are reviewed for both medium–voltage and the until recently unexplored case of low–voltage distribution grids. Different methods applied for both fault location and fault classification are being classified by the implemented technique.

Such methods are explained and analyzed providing the main advantages and disadvantages of each category. Additionally, the research trends in both fields are analyzed and state–of–the–art methods from each category are thoroughly compared. Finally, the research gaps are identified [9].

MasoudAhmadipour, Classification of faults in gridconnected photovoltaic system based on wavelet packet transform and an equilibrium optimization algorithm-extreme learning machine: A novel intelligent scheme using the wavelet packet transform (WPT) and extreme learning machine (ELM) is proposed for fault event classification in the grid-connected photovoltaic (PV) system. The WPT is applied for preprocessing the cycle of the post-fault voltage samples at the point of common coupling (PCC) measurement to get the normalized logarithmic energy entropy (NLEE). The ELM is applied to classify the different fault cases.

To enhance the performance of ELM for faults classification, a hybrid optimization mechanism based on an equilibrium optimization algorithm (EOA) is proposed to optimize the selection of input feature subset and the number of ELM hidden nodes. Furthermore, to evaluate the proposed scheme's performance, a comprehensive evaluation was conducted on a 250 kW grid-connected photovoltaic system. From simulation, the classification accuracy is recorded to be 100% under the no-noise condition, while at the signal-to-noise ratios (SNR) of 30, 35, and 40 dB, the accuracies are 98.96, 99.04, and 99.36%, respectively. Moreover, the practical performance of the EOA-ELM classifier is validated using IEEE 34 bus system. The obtained results validate the effectiveness of the proposed scheme in terms of robustness against

measurement noise, computation time, and detection accuracy [10].

P.Stefanidou-Voziki, Data analysis and management for optimal application of an advanced ML-based fault location algorithm for low voltage grids: As the need for automatization of the electricity grid's fault diagnosis schemes is rising, the application of technologies such as the artificial intelligence (AI) can provide practical solutions to the problem. AI can overcome the challenges that complex topologies like those of the low voltage (LV)smart gridspose and prove to be a powerful tool in the development of advanced fault diagnosis methods. An important parameter for the success of any AIbased method is the quality of data. Therefore, in this paper a data analysis is performed in order to evaluate the type of data produced by a smallLV gridand an representative AI algorithm's response to those.

In the context of this analysis, the most important features and meters were identified. Furthermore, as a response to the large volume of available data, a data management strategy is proposed. The strategy combines original and reshaped features. For this purpose, five dimensionality reduction methods are tested and compared. Truncated-SVD is deemed the most appropriate and is subsequently utilized for the reshaping of the dataset that is introduced to the XGBoost fault location model. The integration of thedimensionality reduction techniquein the algorithm results in the decrease of the computational time and the dataset's size and in a highergeneralizabilityof the algorithm. Thus, the application of the proposed method is not limited by the grid's topology. The method's robustness was verified against various influencing parameters such as the fault resistance, the size of the dataset, the loss of data and the photovoltaics' penetration level. The overall algorithm achieved amean squared errorof 13.26 and a training and test accuracy of more than 99% when tested on the CIGRE LV benchmark grid [11].

MingyaoMa, DC-side faults mechanism analysis and causes location for two-stage photovoltaic grid connected inverters: Due to the deep coupling of the DC faults for the two-stagephotovoltaic(PV) inverters, it is very difficult to determine the specific causes of DC faults. In terms of this issue, the fault mechanism of different causes is analyzed and the obvious fault features are selected to locate the causes. Furthermore, a complete set of fault diagnosis process is proposed for DC over voltageand under voltage faults. An experimental platform for PVpower generation systemis used to simulate the deterioration of operating conditions and obtains various fault data. The results show that the correctness of fault mechanism analysis and the effectiveness of the proposed diagnosis process [12].

SergioMotta, A New Method For Analysing Financial Damages Caused By Grid Faults On Individual CUSTOMERS: Disruptions in electricity supply can cause significant social and economic damages to individual customers connected to the electricity grid, causing loss of income, productivity, and material damages. In this context, considerable investments are required for improving the reliability of the electricity network, and appropriate methods are needed for evaluating the cost-benefit of such investments. This paper proposes a new method for analysing financial damages caused by loss of electricity supply for individual customers, consisting of (i) a model for representing individual customers and their grid connection, and (ii) a method for expressing the reliability of a grid connection in terms of financial damages caused by the loss of electricity supply, defined as Customer Outage Cost, CCOST. These two proposed approaches are combined in a probabilistic method for evaluating the economic impacts of grid faults on individual customers.

Representing grid reliability in financial terms supports the decision-making process of improving the reliability of electricity supply. The methodology is tested with a case study for a rural dairy farm in Finland, where two alternatives for improving the reliability of electricity supply are evaluated: investments in underground cables and in a micro grid, including a cost-benefit analysis of these investments against their yielded reduction in CCOST. The results from the case study show that the proposed methodology appropriately represents an individual customer and its grid connection reliability. In the context of this study, the microgrid approach was the most cost-effective alternative to mitigate the customer damages incurred by grid faults [13].

PingyangSun,AC/DC fault handling and expanded DC power flow expression in hybrid multi-converter DC grids: Hybrid multi-converter dc grids are extended dc grids formed by combinations of different converter topologies such as the linecommutated converter (LCC), modular multilevel converter (MMC), alternate arm converter (AAC) and other various topologies. The stable and secure operation of such systems in steady-stage and transient conditions is critical. This paper investigates the ac and dc fault-ride-through (FRT) capability and the expanded expression of dc power flow in a hybrid multi-converter dc grid consisting of LCCs, MMCs and AACs.

Fault handling schemes of single converters are combined, extended and coordinated to provide satisfactorytransient responseof the hybrid dc grid under both ac and dc faults. This paper proposes an expanded expression of dc power flow considering the initial power flow determination and the power flow after converter outages under mixed P/V and I/V droop control. The expanded dc power flow expression can be used in LCC and modular VSC-based hybrid multi-converter dc grids to derive the initial dc power flow and assess the system static security after converter outages. Simulation results for steady-state and transient operation based on a detailed equivalent model

verify the accuracy of the proposed dc power flow expression, and validate the fault handling capability of the hybrid dc grid [14].

XiaoyuanChen, Superconducting fault current limiter (SFCL) for fail-safe DC-DC conversion: From power electronic device to micro grid protection: In DC micro grids and networks, DC-DC power converters having a large number of semiconductorbased power electronic devices are usually adopted to interconnect the renewable sources and flexible loads. Most of the semiconductor-based devices suffer from poor fault withstanding abilities, but conventional power electronic protection schemes have the bottlenecks of the time-delay, selfmalfunction and mis-judgement.

This paper presents a novel solution using the superconducting fault current limiter (SFCL) to protect a power electronic device and extend the usage to a micro grid. This SFCL is actually a self-triggering, recoverable, and passive current limiter, which does not involve any additional circuit hardware and software. Experimental investigations and simulation analyses clarify the feasibility of using this superconductorbased protection scheme to implement the self-acting fail-safe protection of DC-DC converters. Further system-level simulations explore the SFCL to suppress the over-current and stabilize the bus voltage of aphotovoltaicbased DC micro grid, particularly facing millisecond-level transients and faults [15]

IV.CONCLUSION

Two-way communications are the fundamental infrastructure that enables the accommodation of distributed renewable energy generation. In this paper, we reviewed communication technologies available for the grid integration of renewable energy resources. The concept of wind and solar integration is been discussed, which gives better output, reduce the losses and provides better monitoring ,control and operation is achieved with help of power electronics devices like converters and also with communication technologies. Distinct characteristics in integration of renewable energy resources pose new challenges to the communication systems, which merit further research.

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