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Bidirectional Power Control Approach for AC-DC Converter-Based Super Capacitor Energy Storage System

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Abstract: The stability of a system is basically regionalized networks, also known as micro grids, must be able to operate independently by cutting off their connection to the main grid in order for a system to stay stable. Customers' reliability can be raised by providing a more robust power supply. Due to reversed energy flow from distributed generator units, regional fluctuations, temporary micro grid modes, significant frequency discrepancies in electrically isolated mode operation, as well as financial and supply demand uncertainties, consistency, dependability, and security are in fact with micro grids. In order for a system to remain stable, regionalized networks known as micro grids must be able to function independently by cutting off their connection to the main grid. By offering a stronger power supply, the dependability of consumers can be increased. Consistency, dependability, and security are indeed the main issues with micro grids due to reversed energy flow from distributed generator units, regional fluctuations, transitory micro grid modes, significant frequency discrepancies in electrically isolated mode operation, as well as financial and supply demand uncertainties. This article describes how stability evaluation with MATLAB implements a bidirectional power flow through an interacting converter. Despite the fact that increasing the stability of the hybrid micro grid is their primary goal, the system is more unstable when electrical energy is delivered from the AC side to the DC more dependable and will provide quality supplies.

Index Terms – interlinking converter distributed generators, bidirectional power flow, and hybrid micro grids (HMGs), and some related terms

I. INTRODUCTION

The hybrid microgrids (HMGs) are evolving with the ability to exchange power between ac and dc subgrids. A bidirectional power flow operation of the interlinking converter (IC) is employed to exchange power between ac and dc subgrids in the HMG. The HMG can operate in either grid-connected or islanded mode, and can be controlled in a centralized or decentralized manner. The decentralized control methods, which employ droop characteristics, are widely utilized for power sharing. Although decentralized control methods achieve power sharing between ac and dc subgrids without the need for communication, the HMG. Ability of photovoltaic system to continue operating normally or stably in the event of an interruption is referred to as stability. On the other hand, Destabilization is a state that exhibits a lack of synchronism or a slipping out of synchronization. The importance of electrical grid factors in grid integration has long been recognized. The grid is unable to deliver uninterrupted power as a result. Following the introduction of the hybrid micro grid, this sort of problem will be resolved. The HMG has a wide range of equipment. Decentralized power producing technologies have advanced significantly in recent years as a result of the rising

electrical market and environmental concerns. The benefits of both the AC/DC linked micro grid, which also has a distinctive power generating structure, and the micro grid based on the AC micro grid are integrated. Multiple needs may be met simultaneously by the AC/DC linked power plants of the micro grid. The method makes the most of dispersed renewable energy sources while improving the efficiency of power delivery. A power converter known as a "compound converters" (IC) controls the power conversion between the AC and DC grids in an AC/DC mixed system. The IC must manage the reversible active power connection between the two sub-micro grids in order to appropriately align and optimize the flow of electricity between the AC sub- micro grid and the DC sub-micro grid.

Due to the expanding electricity market and environmental concerns, decentralized electricity generating technologies have made significant strides in recent years. The advantages of the micro grid built on the AC micro grid are combined with those of the AC/DC connected micro grid, which also has a unique power generation structure. The micro grid's AC/DC connected power plants may meet several demands at once. The technique increases the efficiency of the distribution of electricity and makes the most of scattered renewable energy sources. In an AC/DC mixed system, a converter of electricity known as a "compound converters" (IC) regulates the power conversion between the AC and DC grids. In order to properly align and optimize the transfer of electricity among the AC sub-micro grid and the DC sub-micro grid, the IC must handle the reversible active power connection between the two sub-micro grids.

The IC for the sub-micro grids, on the other hand, must concurrently show two different energy and demand parameters at both ends of the grid. Both AC and DC grids may transport power using the integrated distributed generation, which is still under construction. The connectivity, it was already recognized that HMG's dependability is essential for the site during working hours. The operation of the micro grid in islanding mode, as well as the transmission of power from AC to the sub grid's DC and AC, present a number of challenges that the multipurpose power converter architecture seeks to address. It enhances the power quality while also enhancing the power flow through a variety of auxiliary services. It can improve the power supply and reduce the harmonics and transients of the system. As a result, the system is more stable than other systems.

II. Literature survey

This work analyses in depth the conventional droop models used by environmental pollutants linked to the AC and DC sub-microgrids. In order to achieve the voltage stability of standalone composite micro - grids, a reversible sliding mode control approach based on PI control is developed for interlinking converters. The properties of interlinking converters that must sustain AC bus frequencies, DC bus voltage stability, and energy reversible transfer are taken into account in this technique. Complementary energy transfer among AC and DC modules can lessen the effect of each subsystem's departure from the recommended system parameters on the other technologies are describe here [1]. To manage system stability and produce electricity in islanded micro grids, photovoltaic (PV) production and storage technologies are crucial. To preventing the DC bus voltage increase, overcharging, and over discharging of storage areas.

In this study, a distributed approach to synchronize power generators and storage systems is developed based on DC bus voltage signaling. To balance their SOC's and enable the DC bus voltage, a new state- of-charge (SOC) dependent buffer control method for storage areas is first developed. This method can prevent a storage unit from being overcharged. Power generation can be continually managed with an improved power control strategy when the power generation units are not working at their full power point tracking capacity. By using DC voltage signaling, it is feasible to successfully integrate these two strategies for cooperation between generators and storage units. The reliability of the pertinent control mechanism is also examined. [2] By suggesting linear regression compensators built into the internal dynamics of the two energy converters utilised, it is possible to control a grid-connected interconnected grid DC/AC made up of a photovoltaic DC/DC converter, a multimodal lithium battery (LB)-based DC/DC converter, and a grid- connected DC/AC inverter topology.

For the energy converters the recommended control procedure for an appropriate compensation architecture to relate these power supply changes with some other components of the control loop at the same time.

The largest overall result for the compensation elements is obtained by evaluating the natural The system variables'

amplitude and frequency as calculated from the suggested management-based control loops. [3] Though environmentally friendly, rooftop solar generating has unpredictable energy. By managing charge/ discharge, energy storage systems may reconcile the disparity among photovoltaic electricity generation with load energy usage. As a result, a development area has emerged around the control and administration of microgrids made up of parallel hybrid converters and photovoltaic inverters. Every hybrid converter in a network has a varying power output demand for energy is increasing due to the increase in population and the economic conditions of capability due to variations in photovoltaic panels storage, lighting conditions, and storage capacity as well as SOC. In order to regulate the energy output appropriately, it is vital to understand the real energy capacity of every converter. This study examines basic features of parallel inverters in microgrids depending on controller and advances a technique to determine each inverter's power dynamic condition are describe [4].

The stability of these grids under islanding situations is a crucial components the bidirectional power flow in the interconnected inverters (IC) of hybrid ac/dc micro grids (HMGs) made up of distributed energy resources (DGs) with shuttle devices. This study looks into how energy flow direction affects the HMGs with islanding control's modest dependability. Making a linearized state space model of an HMG is the initial step. The dominant modes are represented by the equations in the upper right and are obtained using Eigen analysis. The network of variables and control factors that have the highest effects on stability are found using principal component evaluation, which is the third approach that can be used. The most significant changes dependence and stabilization are then identified using the evaluation. According to the evaluation and vulnerability analyses, the HMGs' dominant modes stabilize when more energy is moved from the DC sub grid to the AC sub grid. Any enhancement to the AC to DC sub grid's power transfer decreases the HMGs' overall reliability. In order to understand how variations in ac and dc drop gain affect the methods under research, it is also examined how susceptible the dominant modes are to these changes. Power is transferred through the IC while this is being done [5].

The power transfer between the ac and dc sub grids The energy flow between ac and dc sub grids can always be effectively managed by using

traditional DC voltage- based drooping techniques for composite AC/DC microgrids linked by a single interlinking converter (IC). Nevertheless, because of the impact of line resistance values, such methods could result in circulation energy with, inside the event of using several ICs in connection its AC and DC sub grids, overstress the ICs. By incorporating an overlapped frequencies inside the DC sub grid, this research suggests an independent power sharing solution for composite micro - grids linked through several ICs. In order to regulate the power between the DC and AC generators, and also the ICs, an appropriate droop strategy is described. The results are adequate DC, proportionate power sharing, and no circulation energy or overloading of the ICs are discussed

The result is adequate DC power, uniform power distribution, and no power circulation or overloading of the ICs. [6] The electric systems goal of an electrical system is to provide sustainable energy sources to society in a safe and affordable manner. Several countries have added a second objective to this goal: meeting all energy needs with sustainable materials, which has led to a shift to low- or zero-carbon power generation. Distributed generation (DER), inverter-based resources (IBR), and differentiated alternative energy sources (AER) are becoming more common in this transformation, which is occurring rapidly around the world. [7]

III. CONCLUSION

The operating point including the amount and direction of the power flow between ac and dc subgrids in an HMG largely affects the stability. Thus, this paper investigated the impact of the power flow on the stability of HMGs formed by the interconnection of ac and dc subgrids through bidirectional ICs. It is observed that as the power flow from the ac to dc subgrid increases, the stability margin of the HMG may be reduced. This is mainly because when the power is exchanged from the ac to dc subgrid, the dynamics associated with the ac subgrid have greater influence on the HMG stability as compared to those of the dc subgrid In the near future, more study should be conducted on the energy variation component of AC/DC hybrid micro grid ICs. Moreover, an increase in the generation capacity of the ac subgrid increases the power flow from the ac to dc subgrid to

supply the dc load power, which could degrade the stability of the HMG

IV. REFERENCES

- [1] K. Li, J. Zhang and J. Zhang, "Research on the Control Strategy of AC/DC Interlinking Converters in Islanded Hybrid Microgrid," 2021 IEEE 4th International Conference on Electronics Technology (ICET), 2021, pp. 479-483, doi: 10.1109/ICET51757.2021.9450958
- [2] E. A. A. Coelho, P. C. Cortizo, and P. F. D. Garcia, —Small-signal stability for parallel-connected inverters in stand-alone ac supply systems,|| IEEE Transactions on Industry Applications, vol. 38, no. 2, 2002, pp. 533–542. F. Gao, S. Bozhko, A. Costabeber, C. Patel, P. Wheeler, C. I. Hill, and G. Asher, Comparative Stability Analysis of Droop Control Approaches in Voltage-Source- Converter-Based DC Microgrids,|| IEEE Transactions on Power Electronics, vol. 32, no. 3, pp. 2395–2415, 2017.
- [3] J. M. Guerrero, L. G. de Vicuna, J. Matas, M. Castilla, and J. Miret, —A wireless controller to enhance dynamic performance of parallel inverters in distributed generation systems,|| IEEE Transactions on Power Electronics, vol. 19, no. 5, pp. 1205–1213, 2004.
- [6] A. Kahrobaei and Y. A.-R. I. Mohamed, —Analysis and Mitigation of Low-Frequency Instabilities in Autonomous Medium-Voltage Converter-Based Microgrids With Dynamic Loads,|| IEEE Transactions on Industrial Electronics, vol. 61, no. 4, pp. 1643–1658, apr 2014.
- [7] H. Liang, B. J. Choi, W. Zhuang, and X. Shen, —Stability enhancement of decentralized inverter control through wireless communications in microgrids,|| IEEE Transactions on Smart Grid, vol. 4, no. 1, pp. 321–331, 2013.
- [8] L. Guo, S. Zhang, X. Li, Y. W. Li, C. Wang, and Y. Feng, —Stability Analysis and Damping Enhancement Based on Frequency-Dependent Virtual Impedance for DC Microgrids,|| IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 5, no. 1, pp. 338–350, mar 2017.
- Y. Li and L. Fan, —Stability Analysis of Two Parallel Converters with Voltage- Current Droop Control,|| IEEE Transactions on Power Delivery, vol. 8977, no. c, pp. 1–1, 2017.
- [9] M. Hamzeh, M. Ghafouri, H. Karimi, K. Sheshyekani, and J. M. Guerrero, —Power Oscillations Damping in DC Microgrids,|| IEEE Transactions on Energy Conversion, vol. 31, no. 3, pp. 970–980, 2016.
- [10] N. Pogaku, M. Prodanovic, and T. C. Green, —Modeling, analysis and testing of autonomous operation of an inverter-based microgrid,|| IEEE Transactions on Power Electronics, vol. 22, no. 2, pp. 613–625, 2007.
- [11] E. Alizadeh, M. Hamzeh, and A. M. Birjandi, —A multifunctional control strategy for oscillatory current sharing in dc microgrids,|| IEEE Transactions on Energy Conversion, vol. 32, no. 2, pp. 560–570, 2016.
- [12] P. C. Loh, D. Li, Y. K. Chai, and F. Blaabjerg, —Autonomous operation of hybrid microgrid with ac and dc subgrids,|| IEEE Transactions on Power Electronics, vol. 28, no. 5, pp. 2214–2223, 2013.
- [13] P. C. Loh, D. Li, Y. K. Chai, and F. Blaabjerg, —Hybrid AC – DC Microgrids With Energy Storages and Progressive Energy Flow Tuning,|| IEEE Transactions on Power Electronics, vol. 28, no. 4, pp. 1533–1543, 2013.
- [14] N. Eghtedarpour and E. Farjah, —Power Control and Management in a Hybrid AC/DC Microgrid,|| IEEE Transactions on Smart Grid, vol. 5, no. 3, pp. 1494–1505, may 2014.
- [15] A. A. Radwan and Y. A.-R. I. Mohamed, —Networked Control and Power Management of AC/DC Hybrid Microgrids,|| IEEE Systems Journal, pp. 1–12, 2014.
- [16] A. A. Radwan and Y. A.-R. I. Mohamed, —Networked Control and Power Management of AC/DC Hybrid Microgrids,|| IEEE Systems Journal, pp. 1–12, 2014.