SURVEY ON TRANSFORMING AN EXISTING DISTRIBUTION NETWORK IN TOAUTONOMOUS MICRO-GRIDUSING PSO TO IMPROVE VOLTAGES PROFILE

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Abstract
A distribution network with renewable and fossil-based resources can be operated as a micro-grid, in autonomous or no autonomous modes. Autonomous operation of a distribution network requires cautious planning. In this methodology to develop a sustainable autonomous micro-grid is presented in this paper. The proposed methodology suggests novel sizing and siting strategies for distributed generators and structural modifications for autonomous micro-grids.
Keyword: Power Loss Minimization, voltage Profile Improvement, micro grid, Distributed power generation.

I. INTRODUCTION

1.1 Introduction

In modern power distribution systems, integrating small non-conventional generation sources has become attractive. These technologies have less environmental impact, easy sitting, high efficiency, enhanced system reliability and security, improved power quality, lower operating costs due to peak shaving, and relieved transmission and distribution congestion. The distributed generator (DG) units used are highly modular in structure as well as helpful in providing continuous power supply to the consumers. However, depending on the rating and location of DG units, there is also a possibility for voltage swell and an increase in losses. In this scenario, to exploit the complete potential of distributed generation, proper siting and sizing of DGs become important. This project, therefore, attempts to develop a sizing algorithm that transforms an existing distribution network to a sustainable autonomous system.[2]
Distributed generation (DG) is proving to be a viable alternative to conventional generation systems. With new technologies like micro turbines, fue.l cells, wind generators, solar cells, etc, getting cheaper their deployment into the grid will increase. Combined heat and power generation is one of the benefits of several DG technologies. Adding new components to a system should comply with better reliability and minimum costs.commonly categorized into three categories: dc-coupled, ac-coupled, and hybrid-coupled.

1.2 Motivation

In a micro grid, the problems of the power quality challenge the reliability and stability of the system operation. Disturbances to the supplied power, which are related to the voltage, frequency, active power, reactive power, harmonic distortion, and dynamic response, can impact performance for both micro grid operation modes: islanding and grid-connected. Recently we focussed on improving power quality by investigating optimal micro grid designs and optimal locations for the connected DG units. This work proposes a new power control strategy, based on a real-time Particle Swarm Optimisation technique, to improve the quality of the power supply in a Micro grid [3]

1.3 Objectives

1. Implementing an optimisation technique for a real-time self-tuning method for the proposed power controller.

2. Controlling the micro grid voltage and frequency in the islanding operation mode.

3. Regulating the active and reactive power flows in the grid-connected operation mode in order to halve the load between the micro grid and utility.

4. Investigating the system's stability under the proposed power controller, and also examining sensitivity to the control parameters, in order to validate the proposed power controller [3]

1.4. Contributions

Based the above objectives, the contributions of this paper should be:

1. The power controller is proposed for the voltage and frequency regulation basedDG unit in a micro grid operation mode. This controller is designed in voltage frequency mode and a Particle Swarm Optimisation algorithm is incorporated for real-time self-tuning method.

II. Literature Survey

F. Katiraei, M. R. Iravani, and P. W. Lehn, have presented in their paper titled "Micro-grid autonomous operation during and subsequent to islanding process,"IEEE Trans. Power Del., vol. 20, no. 1, pp. 248–257, Jan. 2005. This paper investigates (i) replanted switching events and (ii) fault events that lead to islanding of a distribution subsystem and formation of a micro-grid. The micro-grid includes two distributed generation (DG) units. One unit is a conventional rotating synchronous machine and the other is interfaced through a power electronic converter.[1].

T.Q. D. Khoa, P. T. T. Binh, and H. B. Tran, have presented in their paper titled "Optimizing location and sizing of distributed generation in distribution systems," in Proc. IEEE PES Power System Conf. Exposition (PSCE'06), 2006, pp.725–732.This paper investigates With the impending deregulated environment, electric utilities are seeking new technologies to provide acceptable power quality and reliability to their customers. Small nonconventional generation option is rapidly becoming attractive to many utilities because these technologies produce energy with less environmental impact, easy to site, and are highly efficient.[7].

The micro-grid concept acts as technique to the trouble of integrating large quantity of micro generation without interrupting the utility network's operation. The micro-grid or distribution network subsystem will create less trouble to the utility network than the conventional micro generation if there is proper and intelligent coordination of micro generation and loads. [4]

2.1 DC-Coupled Systems

In a dc-coupled configuration, shown in Fig.1 the different AE sources are connected to a dc bus through appropriate power electronic (PE) interfacing circuits. The dc sources may be connected to the dc bus directly if appropriate. If there are any dc loads, they can also be connected to the dc bus directly, or through dc/dc converters, to achieve appropriate dc voltage for the dc loads. The system can supply power to the ac loads (50 or 60 Hz), or be interfaced to a utility grid through an inverter, which can be designed and Controlled to allow bidirectional power flow.

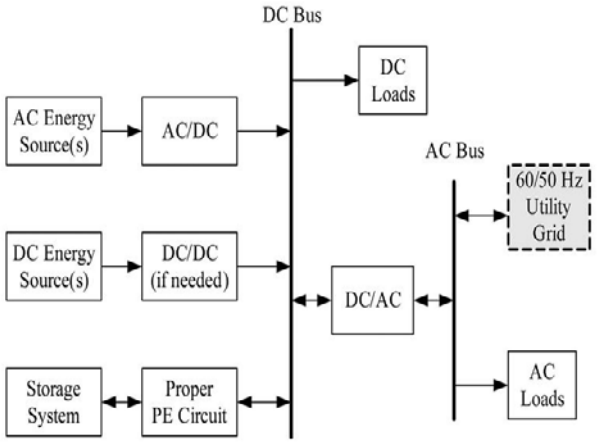

Fig. 1 Hybrid DC coupled circuits

2.2 AC-Coupled Systems

AC coupling can be divided into two subcategories: PFAC-coupled and HFAC-coupled systems. The schematic of a PFAC-coupled system is shown in Fig.2., where the different energy sources are integrated through their own power electronic interfacing circuits to a power frequency ac bus. Coupling

inductors may also be needed between the power electronic circuits and the ac bus to achieve desired power flow management.

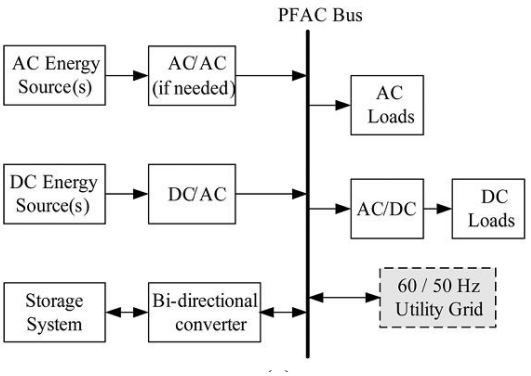

Figure.2. Schematic of ac-coupled hybrid energy system:

2.3 Photovoltaic (PV) Systems

This system in large part is predicated on sunlight for power generation and a cell made from a doped silicon crystal is the key factor. A set of cells can shape a module or panel and several of those can be configured as an array in a photovoltaic device. Driven by green energy policies, photovoltaic farms are being adopted, thus increasing the penetration of photovoltaic arrays. This scenario was uneconomic solution because of the high installation cost and a relatively low power generation. Therefore, small scale distributed PV generation, with ratings ranging from 1 to 100 kW, has been viewed as a more economical solution for reliable power generation. The rating of the photovoltaic array is mostly in the range of 0.3 kW to a few MW. For the cause of supporting green electricity, the use of PV arrays faces major limits First are land costs as 0.25 ha is required to generate 150 kW of electrical energy. Second is climate as reliable operation is only obtained in sunny weather. The voltage fluctuations and harmonic distortion are typically associated with PV systems; however, these can be mitigated through internal controlled-reactive power sources.[4].

II Inverter-Based DG Unit

Typical DG units provide electrical power through conversion processes that can be classified as: high frequency such as micro-turbine generator, variable frequency such as wind turbine, and direct energy such as photovoltaic and fuel cell. An interfacing power electronic converter is required to convert the produced energy from DC to a constant voltage and frequency AC power source. This converter is usually called a Voltage Source Inverter (VSI) system and is the most functional block in the inverter-based DG unit. Figure 3.2 depicts the power circuit of the 3-phase VSI inverter-based DG unit and the associated control functions. The VSI system itself encompasses two main circuits with the first being the power circuit that includes three-leg VSI with an AC filter.

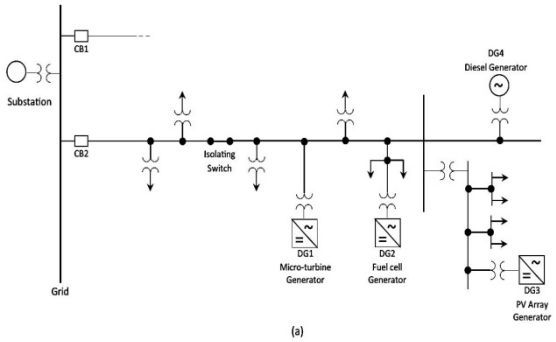

Fig. 3 Grid-connected mode

III. Particle Swarm Optimization (PSO):

The PSO algorithm was proposed by Kennedy and eberhart in 1995. This algorithm simulates the social behaviour of the swarm such as schools of fish, flocks of birds, or swarm of bees where they find food together in a specific area. Therefore, this algorithm uses swam intelligence concept which can be defined as a collective behaviour of unsophisticated agents when they create coherent global functional patterns by interacting locally with their environment. In nature, the journey of the swarm of bees is the best example to understand the conception of the PSO approach. Imagine that this swarm searches to find higher concentration place of the flowers in the field.

V. CONCLUSION AND FUTURE SCOPE

This project for the first time has proposed a methodology for transforming an existing radial distribution system fed from a substation feeder to an autonomous micro-grid. A detailed objective function for converting an existing radial distribution network into an autonomous sustainable micro-grid has been formulated. New techniques for determining the number of units required, siting and sizing of thunits,and structure of the micro-grid have been developed. Two non-traditional optimization

techniques have been employed separately for solving the sizing problem.

VI REFERNCES:

[1] M. VenkataKirthiga, S. Arul Daniel, and S. Gurunathan, "A Methodology For Transforming An Existing Distribution Network Into A Sustainable Autonomous Micro-Grid ," *IEEE Transactions on Sustainable Energy*, Vol. 4, No. 1, January 2013

[2] Mallikarjuna, R. Vallem, and J. Mithra, "Siting and sizing of distributed generation for optimal micro-grid architecture," in *Proc. 37th Ann. North AmericanPower Symp.*, Oct. 2005, pp. 611–616.

[3] WaleedAboodBaddai AL-SAEDI, "Optimal Control of power quality in Micro-grid Using particle swarm optimisation," school of Engineering, faculty of Health Engineering and Science Edith Cowan University, September 15, 2013

[4] LipsaPriyadarshanee, "Modelling and Control of Hybrid Ac/Dc Micro grid," National Institute of Technology, Rourkela, 2012

[5] Mohammad Amin Zamani, "Protection and Control of Active Distribution Networks and Micro grids," University of Western Ontario London, Ontario,Canada, 2012.

[6] F. Katiraei, M. R. Iravani, and P. W. Lehn, "Micro-grid autonomous operation during and subsequent to islanding process," *IEEE Trans.Power Del.*, vol. 20, no. 1, pp. 248–257, Jan. 2005

[7] T. Q. D. Khoa, P. T. T. Binh, and H. B. Tran, "Optimizing location and sizing of distributed generation in distribution systems," in *Proc. IEEE PES Power System Conf. Exposition (PSCE '06)*, 2006, pp. 725–732.

[8] A. Y. Abdelaziz, F. M. Mohammed, S. F. Mekhamer, and M. A. L. Badr, Distribution systems reconfiguration using a modified particle swarm optimization algorithm," *Int. J. Elect. Power Syst. Res.*, vol. 79,no. 11, pp. 1521–1530, Nov. 2009

[9] M. H. Nehrir, C. Wang, K. Strunz, H. Aki, R. Ramakumar, J. Bing, Z. Miao, and Z. Salameh, "A review of hybrid renewable/alternative energy systems for electric power generation: Configurations, control,and applications," *IEEE Trans. Sustain.Energy*, vol. 2, no. 4, pp. 392–403, Oct. 2011.