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Optimal Power Consumption in Micro Grid Based on PV Array

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ABSTRACT

Microgrids provide the ability to take energy from the grid as well as feed power directly to the grid through low voltage networks, thereby allowing the customer to become an active participant in the grid. They should also be able to work in emergency state and be disconnected from the grid, called islanded mode. Prediction and forecasting of renewable energy production plays a key role in microgrid management and control. Prediction algorithms are implemented part of the Energy Information Algorithm of microgrids. In smart microgrid is coupled with power system to deliver a smart system that can provide energy in efficient manner. Energy information system plays, therefore, a key role in managing the resources within the microgrid and can be thought as a layer on the top of the power layer.

KEYWORDS: ***ANN, BPNN, PV Array***

I. INTRODUCTION

The integration of intermittent energy sources in power grids has accelerated the necessity of energy management in a multigenerational source network to ensure a reliable and continuous power supply. The micro-grid concept illustrates these issues by associating a variety of distributed energy sources and loads in a power network capable of an islanding operation with the main grid. The deployments of Micro-grids are expected to impact the economical, environmental, and electricity supply quality and reliability aspects. Indeed, the coordination strategies of controllable local grids can have many drivers, such as reducing carbon dioxide emissions related to energy generation, guaranteeing a low cost of energy, and maintaining high continuity and/or quality of electric supply. Although no current international consensus on the definition has been established, Micro-grids refer to a small scale of the power network, with voltage levels used on the distribution network (=20 kV) and power ratings ranging up to 1 MW. However, some micro-grid projects in islands tend to exceed these average values.

The off-grid operation mode provided by the micro-grid involves the management of several generation sources, both renewable and carbon emitting, combined with conventional and controllable loads. Power electronic and electricity storage devices (such as batteries, flywheels, and ultra capacitors) are also used to manage power fluctuations and supply energy during the transient and steady-state operation of the islanded micro-grid. A large variety of devices connected to the local network may combine alternative and dc operating equipment. Hence, power electronic converters are used to link these elements of various frequencies (nature) to ensure correct operation of generation, storage, and nonconventional loads. Today, Micro-grids use ICTs, such as sensors and smart meters, to evaluate the power flows and balance production and consumption using local energy management systems (EMSs). An EMS includes hardware and software capable of monitoring and controlling power generation units and unconventional loads for safe grid operation and quality of supply. The rest of paper is design as follows.

The overall past work is describe in Section II. Section III describes neural network. Finally, Section IV describes the conclusion of paper.

II. LITERATURE REVIEW

C. Cho, J. H. Jeon, J. Y. Kim, S 2011 [1] a micro grid is an aggregation of multiple distributed generators (DGs), such as renewable energy sources, conventional generators, and energy storage systems that provide both electric power and thermal energy. Typically, a micro grid operates in parallel with the main grid.

C. S. Choi, J. I. Lee, and I. W. Lee, 2012 [2] this paper describes home energy management system for apartment complex which has energy saving facilities such as BIPV (Built-in Photovoltaic) and motorized blinders.The proposed complex home energy management system provides optimal energy saving solutions to the apartment complex which has energy facilities.

H. Beltran, 2012 [3] this paper analyzes the effect of introducing energy storage (ES) system in an intermittent renewable energy power plant such as a photovoltaic (PV) installatio. It can be concluded that significant improvements in production predictability are achieved with an ESS energy capacity of approximately 50% of the average daily energy produced by the PV panels and a power rating of around 55% of the plant's rated power. All the results are based on 1-year-long simulations which used real irradiance data sampled every 2 min.

H. Gaztanaga, J. Landaluze, I. Etxeberria-Otadui 2013 [4] In this paper an enhanced experimental photovoltaic (PV) plant configuration including a storage system and a centralized plant controller is presented as a solution to improve PV systems integration into the grid. then, experimentally validated in a 1.2MW PV plant located in Tudela (Navarre, Spain) and owned by AccionaEnergía, demonstrating a considerable grid-integration improvement.

V. Gevorgianand S 2013 [5] The U.S. Department of Energy (DOE) and the National Renewable Energy Laboratory (NREL) have partnered with the Government of Puerto Rico to assist in addressing barriers to the deployment of energy efficiency and renewable energy in Puerto Rico. The PREPA MTRs are anticipated to constantly evolve as the level of renewable penetration increases, modeling tools are improved, and experience with system performance increases. This review is intended to assist PREPA in this process.

Y. Riffonneau, S. Bacha, F. Barruel, and S. Ploix 2011 [6] this paper presents an optimal power management mechanism for grid connected photovoltaic (PV) systems with storage. The objective is to help intensive penetration of PV production into the grid by proposing peak shaving service at the lowest cost. In real conditions, efficiency of the predictive schedule depends on accuracy of the forecasts, which leads to future works about optimal reactive power management.

J. M. Guerrero 2013 [7] this paper summarizes the main problems and solutions of power quality in microgrids, distributed-energy-storage systems, and ac/dc hybrid microgrids. First, the power quality enhancement of grid-interactive microgrids is presented. Finally, the coordinated

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control of distributed storage systems and ac/dc hybrid microgrids is explained.

F. R. Yu, P. Zhang, W. Xiao, and P 2011 [8] there is growing interest in renewable energy around the world. Since most renewable sources are intermittent in nature, it is a challenging task to integrate renewable energy resources into the power grid infrastructure.

E. Romero-Cadaval, G 2013 [9] the main design objective of photovoltaic (PV) systems has been, for a long time, to extract the maximum power from the PV array and inject it into the ac grid. Therefore, the maximum power point tracking (MPPT) of a uniformly irradiated PV array and the maximization of the conversion efficiency have been the main design issues..

Y. Wang, P. Zhang, W. Li, W. Xiao, 2012 [10] for grid-connected microgrids with high penetration of photovoltaic (PV) generation, overvoltage caused by reverse power flow is a major factor that limits PV power output. To tackle the challenge, this paper proposes a new online overvoltage prevention (OOP) control strategy to maintain PV terminal voltages within specified range while maximizing the PV energy yields.

F. Chanand H. Calleja 2011 [12] this paper presents the reliability estimation of the power stages in three grid-connected photovoltaic systems. The circuits analyzed are an integrated topology, a two-stage configuration, and a three-stage one, all commutating in the hard-switching mode.

Z. Moradi-Shahrbabak, A. Tabesh, and G. R. Yousefi 2014 [13] This paper presents an algorithm for the economical design of a utility-scale photovoltaic (PV) power plant via compromising between the cost of energy and the availability of the plant. Given the price of commercially available PV inverters at present, the case studies in this paper show that, for 0.1-100-MW PV power plants, the economical ratings of inverters range from 8 to 100 kW.

P. E. Kakosimos, 2013 [14] In this paper, a photovoltaic (PV)-system maximum power point (MPP) tracking (MPPT) control strategy employing a predictive digital current-controlled converter implemented in conventional hardware resources is presented.

C. Benoit etal 2013 [15] this paper investigates a formulation of the Optimal Power Flow (OPF) problem, which aims to find the predictive optimal operational state of a low voltage smart grid.

III. Neural Network

A neural network is a powerful data-modeling tool that is able to capture and represent complex input/output relationships. The motivation for the development of neural network technology stemmed from the desire to develop an artificial system that could perform "intelligent" tasks similar to those performed by the human brain. Neural networks resemble the human brain in the following two ways:

- A neural network acquires knowledge through learning.
- A neural network's knowledge is stored within inter-neuron connection strengths known as synaptic weights.

Artificial Neural Networks are being counted as the wave of the future in computing. They are indeed self-learning mechanisms which don't require the traditional skills of a programmer. But unfortunately, misconceptions have arisen. Writers have hyped that these neuron-inspired processors can do almost anything. These exaggerations have created disappointments for some potential users who have tried, and failed, to solve their problems with neural networks. These application builders have often come to the

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conclusion that neural nets are complicated and confusing. Unfortunately, that confusion has come from the industry itself. An avalanche of articles has appeared touting a large assortment of different neural networks, all with unique claims and specific examples. Currently, only a few of these neuron-based structures, paradigms actually, are being used commercially. One particular structure, the feed forward, back-propagation network, is by far and away the most popular. Most of the other neural network structures represent models for "thinking" that are still being evolved in the laboratories. Yet, all of these networks are simply tools and as such the only real demand they make is that they require the network architect to learn how to use them. The power and usefulness of artificial neural networks have been demonstrated in several applications including speech synthesis, diagnostic problems, medicine, business and finance, robotic control, signal processing, computer vision and many other problems that fall under the category of pattern recognition. For some application areas, neural models show promise in achieving human-like performance over more traditional artificial intelligence techniques.

IV. Conclusion

Prediction and forecasting of renewable energy production plays a key role in microgrid management and control. Prediction algorithms are implemented part of the Energy Information Algorithm of microgrids. In smart microgrid is coupled with power system to deliver a smart system that can provide energy in efficient manner. Energy information system plays, therefore, a key role in managing the resources within the microgrid and can be thought as a layer on the top of the power layer. Algorithm has the objective of making sure the microgrid is stable, reliable, and resilient (can work in normal or standalone mode). Algorithm must also have the capability of interacting with the smart grid market as well as other nearby microgrids.

References:

1. C. Cho, J. H. Jeon, J. Y. Kim, S. Kwon, K. Park, and S. Kim, “Active synchronizing control of a microgrid,”IEEE Trans. Power Electron., vol. 26, no. 12, pp. 3707–3719, 2011.
2. C. S. Choi, J. I. Lee, and I. W. Lee, “Complex home energy management system architecture and implementation for green home with built-in photovoltaic and motorized blinders,” in Proc. IEEE 2012 Int. Conf. ICT Convergence (ICTC), Oct., pp. 295–296.
3. H. Beltran, I. Etxeberria-Otadui, E. Belenguer, and P. Rodriguez, “Power management strategies and energy storage needs to increase the operability of photovoltaic plants,” J. Renewable Sustain. Energy, vol. 4, p. 063101, 2012.
4. H. Gaztanaga, J. Landaluze, I. Etxeberria-Otadui, A. Padros, I. Berazaluce, and D. Cuesta, “Enhanced experimental PV plant grid-integration with a MW lithium-ion energy storage system,” in Proc. IEEE Energy Conversion Congr. and Expo., 2013, pp. 1324–1329.
5. Gevorgianand S. Booth, “Review of PREPA technical requirements for interconnecting wind and solar generation,” Tech. Rep. NREL/ TP-5D00-57089, Nov. 2013, Contract No. DE-AC36-08GO28308.
6. Y. Riffonneau, S. Bacha, F. Barruel, and S. Ploix, “Optimal power flow management for grid connected PV systems with batteries,” IEEE Trans. Sustainable Energy, vol. 2, no.3, pp. 309–320, 2011.
7. J. M. Guerrero, P. C. Loh, T. l. Lee, and M. Chandorkar, “Advanced control architectures for intelligent microgrids—Part

II: Power quality, energy storage, and AC/DC microgrids," IEEE Trans. Ind. Electron., vol. 60, no. 4, pp. 1263– 1270, Apr. 2013.

8. F. R. Yu, P. Zhang, W. Xiao, and P. Choudhury, "Communication systems for grid integration of renewable energy resources," IEEE Network, vol. 25, no. 5, pp. 22–29,Sept.–Oct. 2011.
9. E. Romero-Cadaval, G. Spagnuolo, L. Garcia Franquelo, C. A. Ramos-Paja, T. Suntio, and W. M. Xiao, "Grid-connected photovoltaic generation plants: Components and operation," IEEE Ind. Electron. Mag., vol. 7, no. 3, pp. 6–20, Sept. 2013.
10. Y. Wang, P. Zhang, W. Li, W. Xiao, and A. Abdollahi, "Online overvoltage prevention control of photovoltaic generators in microgrids," IEEE Trans. Smart Grid, vol. 3, no. 4, pp. 2071–2078, Dec. 2012.
11. F. Chanand H. Calleja, "Reliability estimation of three single-phase topologies in grid-connected PV systems," IEEE Trans. Ind. Electron., vol. 58, no. 7, pp. 2683–2689, July 2011.
12. Z. Moradi-Shahrbabak, A. Tabesh, and G. R. Yousefi, "Economical design of utility-scale photovoltaic power plants with optimum availability," IEEE Trans. Ind. Electron., vol. 61, no. 7, pp. 3399–3406, July 2014.
13. P. E. Kakosimos, A. G. Kladas, and S. N. Manias, "Fast photovoltaic-system voltage- or current oriented MPPT employing a predictive digital current-controlled converter," IEEE Trans. Ind. Electron., vol. 60, no. 12, pp. 5673–5685, Dec. 2013.
14. C. Benoit etal., "Deterministic optimal power flow for Smart Grid short-term predictive energy management," in Proc. 2013 IEEE Grenoble PowerTech, pp. 1–7.
15. Z. Moradi-Shahrbabak, A. Tabesh, and G. R. Yousefi, "Economical design of utility-scale photovoltaic power plants with optimum availability," IEEE Trans. Ind. Electron., vol. 61, no. 7, pp. 3399–3406, July 2014.
16. R. Cossent, L. Olmos, T. Gomez, C. Mateo, and P. Frias, "Distribution network costs under different penetration levels of distributed generation," Eur. Trans. Electr. Power, vol. 21, no. 6, pp. 1869–1888, Sept. 2011.
17. Lasseter, Robert H., Joseph H. Eto, B. Schenkman, J. Stevens, H. Vollkommer, D. Klapp, E. Linton, Hector Hurtado, and J. Roy. "CERTS microgrid laboratory test bed." IEEE Transactions on Power Delivery 26, no. 1 (2011): 325-332.
18. R. Smithand S. Killa, "Bahrain World Trade Center (BWTC): The first large-scale integration of wind turbines in a building," Struct. Des. Tall Special Build., vol. 16, no. 4, pp. 429–439, 2007.
19. D. M. Hanand J. H. Lim, "Design and implementation of smart home energy management systems based on ZigBee,"IEEE Trans. Consumer Electron., vol. 56, no. 3, pp. 1417–1425, 2010.

DOI: 10.18535/etj/v2i11.04
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