

A REVIEW ON MICROGRID WITH DISTRIBUTED ENERGY RESOURCES

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Abstract— As one of the key advances to accomplish the vast scale use of distributed power generation, micro grid can beat the irregularity, discontinuity and dispersity caused by distributed energy and advance the improvement and use of new energy and renewable energy to facilitate the deficiency of energy everywhere throughout the world. In this paper, the qualities and key innovation of micro grid and the difficulties may exit amid advancement of microgrid are quickly presented. Microgrid follows the necessities to advance renewable energy power generation and social sustainable improvement, and will possess an imperative position in the advancement of grid development.

Keywords- Microgrid; Challenge; Distributed generation systems

1. INTRODUCTION

Because of the restricted amount of customary petroleum products and the ecological contamination issue, the improvement and usage of sustainable power source has been given careful consideration everywhere throughout the world and the scale is growing. As the center substance of vitality change and the essential duty to manage the atmosphere, China has made the target that the extent of non-petrochemical vitality utilization expanded to 15% of essential vitality utilization and 20% in 2020 and 2030 separately. isolated As one of the key technologies to realize the large-scale application of distributed power generation system, "microgrid" aims at realizing the flexible and efficient application of distributed power generation technology in medium and low voltage level and solving the problem when large and diversified distributed energy operates in distribution network . So the development of microgrid to a certain extent determines the application scale of renewable energy. In this paper, the development of microgrid at this stage and the problems exits during development are briefly introduced.

2. CONCEPTS AND CHARACTERISTICS

A. The concepts of microgrid

microgrid is a network comprising of load and smaller than expected power supply, which gives both electric and thermal power. The power supply inside the microgrid is power electronic converters which are in charge of energy transformation and give the important control. Contrasted with the large grid, the micro grid acts as a solitary controlled unit and at the same time meets the consumer's necessities for power quality and power supply reliability . From that point forward, the European Union and Japan give their very own definition because of their exploration. Our nation advances the idea of micro grid in a " micro-network technology system research" work meeting held by the State Grid Electric Power Research Institute in 2009, microgrid is a little measured, decentralized energy supply arrange dependent on appropriated power generation innovation with the subject of decentralized assets and little power plants and joined with power quality management and energy storage technology . Despite the fact that the meaning of microgrid are not the equivalent, they do all recognize that the micro grid is a coordinated unit of energy storing devices, control equipments and protection equipments , which dependent on distributed energy generation sources and can work in isolated mode and grid connected mode.

B. Characteristics of micro grid

flexibility: As characterized in the paper, the smaller scale grid can run both in isolated system and grid-associated. The grid-associated mode goes about as the ordinary task, in which the system can either ingest power from the grid system or supply power to the utility grid. When something happens to the grid, the micro grid disengages the connection with the utility grid by opening the division switch and transformed into isolated system mode.

Interactivity : Operating in isolated system state can abbreviate the client's power blackout time, as well as help the reboot of the mass grid, which is especially important during the unpredictable disaster or war. So the " micro grid "can assume a job as possess crisis power supply, which ought to be considered in the " grid black start " program.

compatibility : Micro grid is the best method to accomplish the association of distributed power. It coordinates the original distributed energy and balances out the power supply and demand through energy storage and control security, which successfully conquer the irregularity and discontinuous of dispersed energy and take care of the issue when microgrid associates with the utility grid

Economy: Micro grid access to vast amount of renewable energy, which implies we can distribute the output of distributed sources optimally. Also, joining the microgrid with medium-sized heat supply can diminish the transformation of various energy frames and enhance energy productivity, improve the energy structure so as to accomplish the best financial advantages of microgrid through the acknowledgment of temperature counterparts, course use and energy coordinating.

3. KEY TECHNOLOGY OF MICRO GRID

A. The operation of the micro grid

As referenced in this paper, the microgrid can work in isolated system running and grid-associated running. At the point when associated with the utility grid, the microgrid can give abundance power created by disseminated energy to the grid or supplement their very own power generation inadequacies from the grid. When recognizing the failure of the grid or the power quality does not meet the prerequisites, the microgrid

will separate from the large system and the power supply will be given by the distributed energy resources (DERs). The isolated system running of the microgrid gives a higher power supply unwavering quality and irreversible power supply for the network. Through test framework activity, incidentally, the microgrid can be associated organize or isolated system and change from one state to the next easily under reasonable control technique.

B. The control of microgrid

As a secluded and controllable unit, microgrid need to give power to consumer and to accomplish this, the great administration and control inside the microgrid is vital. Through the microgrid control, altering the feed stream to decoupling control the active and reactive power autonomous and ensure that the activity of each small scale power can be micro-response and supply the consumer demand.

During the time of process control, the microgrid can make a fast and free reaction to the mishap happened in the large grid dependent on the neighborhood data. At the point when the voltage drops in the associated system or power outage, the micro distributed sources will be changed to partition of the fundamental system or parallel or accomplish the progress between the two activity show as indicated by the fault condition or the system smoothly. These days, there are three principle strategies to control the microgrid. First is "plug and play" control and "peer to peer" control dependent on power electronics devices. Second is the control dependent on power management system. and third is microgrid control dependent on multi-operator technology. The principle control gear is th distributed generation controller, controllable load manager, central energy management system and relay protection device

C. Energy Storage Technology

Given the fact that the ability of microgrid to bear the disturbance is relatively weak, the application of energy storage system plays an important role in stabilizing the fluctuation of renewable energy and maintaining the stable operation of the system. There are different storage technologies and the main technologies are mechanical energy storage, electromagnetic energy storage and electrochemical energy storage etc. Among all these storage technologies, batteries become the best option for renewable energy grid and intelligent micro-network because of its easy installment and manufacture. Lithium-ion batteries, nickel-metal hydride batteries, sodium sulfur batteries, liquid batteries, lead-acid battery technology are relatively mature in a variety of chemical batteries and the comprehensive performance of lithium battery is the best while liquid batteries has a wild application in the field of large-scale. The best energy storage technology works for the microgrid is those with high system efficiency, long cycle life and high economy.

D. Economics of microgrid

The economics is the important foundation for promotion and development of microgrid technology. Microgrid can refer the knowledge and experience obtained from the operation of grid in scheduling principles, power transactions, resource optimization and other aspects to optimize the design and provide different levels of power quality and reliability services for different customers and even provide black start and other auxiliary services. At the same time, the economic optimization of microgrid is also different from the traditional grid and the biggest difference is that distributed generation can supply electricity and heat in the form of CHP. In addition, the unique design of the microgrid can provide higher reliability than traditional distribution network and meet the special requirements of customers, improve the added value of electricity.

4.THE CHALLENGES IN THE DEVELOPMENT OF MICROGRID

The ultimate goal of microgrid is to achieve seamless incorporation of a variety of distributed power supply. In general, a large amount of distributed power supply connected to the microgrid will obviously have a profound impact, therefore we need to address the operating characteristics and the interaction mechanism between traditional grid and microgrid, grasp energy optimization management and other aspects of a series of complex issues.

Reliability and Stability: Microgrid is distributed in the distribution grid as a special power source which can both import and export energy, the interaction between the microgrid will further affect the reliability of the distribution grid. The mechanism of the interaction between the microgrid and the distribution grid is the prerequisite for improving the safety and stability of the distribution grid, and it is necessary to discuss the new theory and method to analysis stability and reliability.

Programming and Designing: It is necessary to consider a series of problems during the programming and designing, such as distributed power supply, microgrid structure, the location of micronet access and integrated optimization of distribution grid. The demand of cold and thermal load in the grid should also be considered to reflect the scientific and forward-looking of programming.

Controlling: The distributed power supply mostly connects the grid through electronic inverter because there is no self-synchronization. The load fluctuation in microgrid and distribution grid has a great impact on the power output. The diversity, intermittent and randomness also increase the difficulty of voltage and frequency control in distributed power supply and the control of coordination between multi-micro-grid is more difficult. Besides, the power quality is also a concern that we should pay attention to.

Protection: Because of the bidirectional trend of microgrid, it is our primary task to ensure the safety and stability of the entire system when some failure happened and when there is something wrong with the distribution network or the distribution network operates under abnormal condition, it's necessary to protect the distributed power and microgrid, response when it's required, don't operate when there is no need, response rapidly. In addition, different distributed generation technologies may have different protection criteria when system fails and network reconstruction also requires protection device with adaptive tuning function.

Scheduling Operation: Due to its complexity, the effective scheduling and management of microgrid must be achieved by using auxiliary tools. First of all, we need to model and simulate the microgrid to achieve rapid protection for isolated network state and grid reconstruction algorithm, overcome the unfavorable factors of intermittent and randomness brought by renewable energy under the high permeability to ensure the safety and stability of the system under extreme weather conditions and failure condition.

5.DEVELOPMENT DIRECTION

Microgrid technology has been vigorously researched recently with its high reliability, environmental protection, flexibility and other characteristics in developed countries, such as Europe and the United States. Our country also began some National High-tech R&D Program (863 Program), National Key Basic Research and Development Program (973 Program), and other national key research and development plan to encourage and support the various universities and research institutes in the microgrid technology research. The next few years, microgrid theory and related technology will be certificated through demonstration engineering and get widely practiced and promoted. In the future, the main research direction of microgrid will be as follows:

The different ways to connect microgrid to traditional grid and operate isolated network, the coordinated control of the microgrid and energy storage components make the energy flow in microgrid multi-path and multi-channel, therefore we need to establish suitable theory about grid

structure planning and operational and other related aspects according to the above characteristics; Design a real-time, flexible, intelligent distributed power controller and central management unit for distributed generation system with renewable energy such as wind power to enable it to have complex functions such as self-healing, autonomous and self-organizing [11]. In addition, according to the requirements of the load (sensitive load and non-sensitive load) and the operation of the power grid, optimize and improve the control strategy, especially the integration of different control strategies, coordination and smooth transition to explore the appropriate operation mode and management strategies for microgrid; Using neural network, wavelet analysis, gray theory and system prediction technique establishes the random load model. Based on the scheduling scheme of the main network and the load capacity of the microgrid and the requirements for power quality, and combine the intelligent control (artificial neural network, fuzzy control) and modern control theory, to establish internal random flow control model for microgrid. Establish the new economic relations between the main grid and microgrid, research and formulate the technical guidelines for isolated network running and grid-connected running properly, especially the operational specification for micro-distributed power supply under isolated network running and investigate the impact of technology promotion on electricity market further.

6.CONCLUSIONS

In the context of the energy shortage globally, microgrid has aroused concern around the world as the effective complement to the traditional grid and the effective forms to use distributed energy. Compared with the traditional centralized power supply system, microgrid can reduce the loss greatly and save investment for transmission and distribution construction. As aggregate of power generation, heating, cooling and other service functions, microgrid can effectively achieve the cascade utilization of energy to achieve higher energy efficiency, while improving the safety and reliability of power supply. Microgrid can effectively reduce or eliminate the direct impact to grid caused by access of distributed power supply, which provides a new path for the large-scale application of new and renewable energy in connected grid. Microgrid complies with the requirements to promote renewable energy power generation and social sustainable development, and will occupy a vital position in the development of construction of grid.

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