New Energy Micro Network Communication System under Intelligent Electricity Method Research

Qingwen Chen

Power china Northwest Engineering Corporation Limited

Email: 18681880525@163.com

Keywords: New Energy; Micro Power Grid; Communication System; Smart Power

Abstract: The theoretical basis of new energy micro grid has made obvious progress so far, mainly involving the communication protocol between networks, simulation modelling of micro grid, protection strategy and control methods. Renewable energy generation is also beginning to take shape, and across the country, most of it is distributed. These new energy generation forms can effectively improve energy utilization efficiency and supply stability, but with the integration of distributed power supply into the grid, the power system will inevitably face some new problems and challenges. As an essential material for economic development and human survival, if energy is not utilized efficiently or imbalanced, it will inevitably lead to the deterioration of ecological environment and hinder the healthy development of economy. Therefore, this paper will explore a smart power consumption strategy based on the new energy micro grid system, and describe its main equipment, control methods, main functions in detail, and test its actual energy-saving effect. The research results show that the smart power consumption strategy proposed in this paper has obvious energy-saving effect.

1. Introduction

The trend of intelligent power grid system management is becoming the trend of upgrading and transformation of the power industry all over the world, and it has been rationally recognized that clean energy, distributed generation, active distribution and other new technology concepts are the commanding heights of industry transformation and upgrading [1]. By integrating with communication system and Internet of things technology, electric energy can be completely intelligent and integrated and develop towards integration [2]. With power grid, for implementation of interference from the power quality control, implementation of perception and the user's individualized demand, to realize fault isolation or line automatic switching network area automatically, etc all have to rely on efficient data transmission system, the control device is connected to the distribution network together, the real-time data acquisition, analysis and control measures will be enough to will likely abnormalities, such as interference elimination in the bud [3-5]. At the same time, through integration with comprehensive services, zero-delay response of power supply service, support for personalized customization, automatic fault detection and repair will be realized [6]. In this process, the distribution grid strategy is the core of the unified smart grid. It will directly serve the power supply network and realize the interaction between users and the grid, which is also the development goal of the distribution grid [7].

In the existing studies, the United States is the first country to put the first generation of smart grid into use [8]. In 2000, the American academy of electric power science took the lead in launching the research project of load interactive network, which is also the embryonic form of smart grid in all western developed countries [9]. Foreign research on smart grid is generally reflected in the following two aspects: first, the innovation and research and development of distribution business; The second is the study on the application of smart grid in the overall communication architecture [10]. Through the study of the above two points, the power distribution network control center is connected with the intelligent device to realize the functions such as user demand response and equipment status acquisition [11]. After a long time of experience

  DOI: 10.25236/icme.2019.034

accumulation, China's power system has already formed the resource framework of the state grid, and formed the goal of building an uhv backbone grid with automation and interaction by adhering to independent innovation [12-13].

As a core component of the power grid system, distribution network is directly facing users and is also the key to guarantee a safe and orderly electricity environment [14]. In the long run, smart distribution will be the core of the smart grid of the future. This article will discuss including the concept of intelligent power distribution network, focus on form, and the fusion approach of demonstration for distributed power grid design is proposed, respectively from the security, reliability, sexual and other indicators to evaluate the pros and cons of each strategy, and then put forward in this paper the differential technology solutions of power communication network architecture, layout, architecture, etc., finally analyze the effect of the proposed intelligent electricity strategy and validation [15].

2. Method

2.1 Core Concepts

(1) Microgrid

Micro-grid can be divided into three types: hybrid micro-grid, dc micro-grid and ac micro-grid. The architecture of dc microgrid is the development direction of the future power grid, but it is only in the initial stage at present, and the planning and design lack of mature and unified standards, and does not have the conditions for large-scale popularization. In ac microgrid, the distributed power supply with ac output connected to the ac bus is the key to the good operation of ac microgrid. Hybrid microgrid can supply power to both ac load and dc load directly, which solves the trouble caused by multiple conversions. Therefore, ac microgrid has higher flexibility and efficiency, and is the most potential distribution network application form in the future.

2.2 Data Transmission Index of Intelligent Distribution Communication

The data information flow of intelligent distribution communication transformation is estimated according to the following methods:

Firstly, it is necessary to configure the access requirements of basic services of the power grid, mainly including the data perception and fault automatic processing of the distribution network, the business of solar or wind new energy power stations, the field monitoring of video data of distribution network equipment and lines, and the electric energy storage business applicable to the distribution of the distribution network. According to the actual situation of the existing power grid, the junction point of data and the information in the distribution network can be used to select the power station in the distribution network area as the data settlement point. In this case, the total demand for data B is:

$$B = (\sum D + V \times n \times k1) \times (1 + k2) \quad (1)$$

Where, ∑D is the total amount of data services, k1 is the simultaneous rate of video monitored services, k2 is the reserved amount of broadband service traffic data, V is the basic service data traffic monitored by video, and n is the number of services monitored by video. The composition of data business aggregate ∑D is:

$$\sum D = D_1 + D_2 + D_3 + D_4 + D_5 + D_6 + D_7 + D_8 \quad (2)$$

Where, D1 is the business volume of variable data, D2 is the business volume of distributed energy storage system, D3 is the business volume of the power distribution station, D4 is the business volume of outgoing switch data, D5 is the business volume of photovoltaic power station data, D6 is the business volume of ring network cabinet data, D7 is the business volume of switch data on the pole, and D8 is the business volume of switch data on the column.

2.3 Selection of Distribution Communication Networking Technology

The main business carried by the communication network is the collection of electricity information and the automation of distribution.

Due to the high demand of distribution of broadband communication network, the network security performance and reliability required, so the power of private network of optical fibers and auxiliary, broadband wireless communication mode is the most ideal choice for communication operators, but the common network communications limited to don't need the application of remote terminal, and can realize the goal in a short time complete coverage of electric power network.

System networking is a reasonable arrangement of sub-network configuration of the construction scheme, can better solve the application of supporting optical cable. The layout of new and old lines is realized. According to the link characteristics of the distribution network information, the most suitable splitter for the network module is the uniform module to ensure the flexibility and expansibility of the microgrid.

3. Planning and Design of Smart Power Consumption for Micro Grid

The planning and design of smart electricity strategy is the basic premise for microgrid to be put into economic operation. Only after its technical feasibility, economic feasibility and environmental friendliness are verified, can the electric load be accurately calculated. Specific target setting and operation condition constraints, design model and planning design are established to combine the best network architecture, microgrid control strategy, security protection mechanism and energy storage system capacity.

Planning and design under the guidance of network is a multi-variable and multi-objective mixed linear problem, which has great uncertainty from solving algorithm and modeling method. Renewable resources and load demand distribution provides two analytic solution, summarizes the possible in the design of micro power grid planning project income, operation objectives, constraints and optimization variables, using the HOMER analysis software compatible performance of ruling power grid, and starting from the planning and design of the distributed power grid to find design optimization algorithm, thus forming an integrated micro grid intelligent electricity strategy plan.

The theory of micro-grid planning and design is not mature enough. It is necessary to gradually establish a scientific and complete design evaluation system, so as to find out an accurate design optimization algorithm, design a systematic and complete analysis and evaluation system, and make the micro-grid design practice get a reasonable scientific evaluation index.

4. Discuss

The traditional power distribution network is constructed as a transmission distributed network for the purpose of clean energy, so as to build a network with intelligent characteristics, which can be called intelligent power distribution micro network. Its simulation rendering is shown in figure 1 below. The implementation of this model can satisfy the development of distributed energy and make distributed clean energy an important part of China's renewable resources in the future. Among them, the distribution network is directly facing customers, which is the core part of the power grid, as well as the key measure to ensure the power supply and improve the operation efficiency of the power grid.

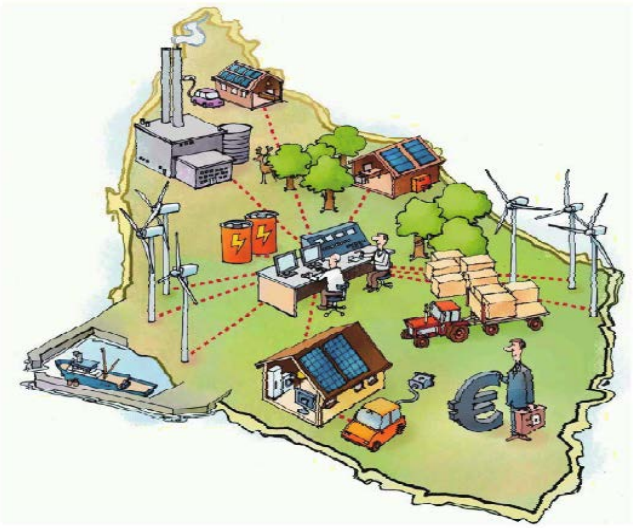

Figure 1. Rendering of intelligent power distribution under micro network

4.1 Technical Performance Analysis

(1) Bandwidth capability analysis

In the network business logic layer of intelligent distribution, only the flow rate of video monitoring service needs to reach 1024bit/s, while the rest of the service is generally no more than 32bit/s. However, the actual available flow of each 10kv dedicated line is 128kbit/s. Therefore, the total service flow of the management area is about 2048kbit/s, but 50% of the flow margin and 25% of video monitoring flow margin must be considered.

At various technical levels, Ethernet technology can achieve a transmission rate of 1Gbit/s. The transmission rate of EPON technology can reach 1.28Gbit/s. The transmission band of wi-fi is 300Mbit/s; ZigBee band is about 5.12Gbit/s; The spectrum of medium pressure BPLC can provide a physical layer rate of about 200Mbit/s. The specific performance index obtained from the test is shown in table 1 below.

Table 1. Broadband performance analysis results

Business types		Patch	Line	Substation allowance	
Production control information		＜32bit	77.87kbit/s	2.56Mbit/s	
Management information service	Does not contain video service	/	/	5.12kbit/s	
	Contains video services	1024bit/s	2048bkit/s	1.02Gbit/s	
Communication mode	Ethernet	EPON	WI-FI	ZigBee	Medium voltage BPLC
Broadband capabilities	1Gbit/s	1.28Gbit/s	300Mbit/s	5.12Gbit/s	200Mbit/s

(2) Real-time analysis

Distribution network automation business is business, on the top of intelligent power distribution real-time demand in general, optical fibers telemetry communication distance station by electron transfer to the main power station of time less than 4 seconds, and passed to the host from the terminal time is usually not more than 3 seconds, remote execution, the undo command transmission time is about 10 seconds, invalid telemetry is passed to the main distribution power station is usually not more than 60 seconds, carrier communication mode to a main distribution under the standing time is 30 seconds, by the time of the terminal is passed to the master station is 40 seconds, remote control command, the command for 60 seconds. In this paper, the real-time indicators of these technologies are measured one by one, and the measurement results are shown in figure 2 below.

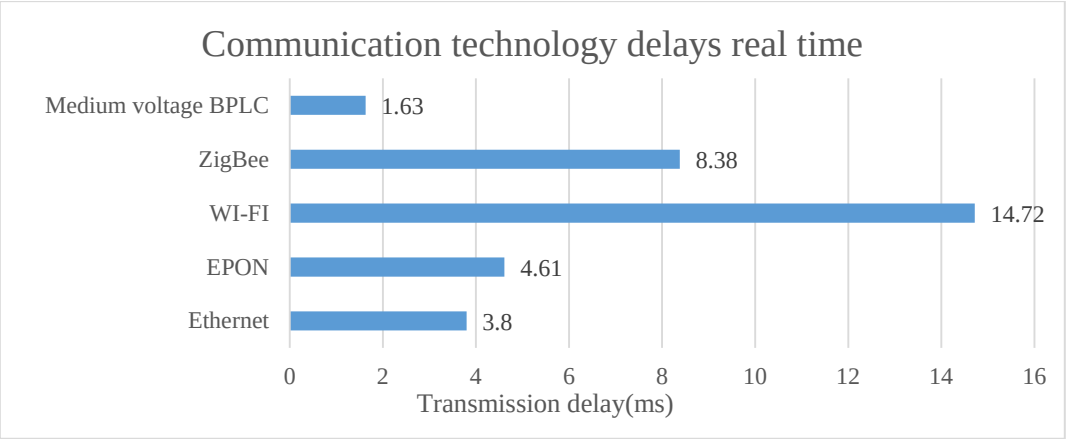

Figure 2. Real-time analysis results of communication technology

4.2 Basic Strategies for Building Smart Distribution Network

The transformation and development of the economy make people's awareness of clean energy more and more strong. The micro-grid smart electricity consumption dominated by new energy is bound to be the inevitable trend of the future energy development model. Smart power network access to the power grid system realizes the interaction between the power grid and users. Therefore, smart power distribution has become an important part of the smart grid and will be the core of the smart grid in the future.

(1) Build demonstration projects

Clean energy diversification of adumbrative development mode of diversification, containing micro power grid of distributed power supply under normal conditions can be implemented with the main communication, even if the main malfunctions can guarantee power alone, therefore, it is necessary to strengthen the pilot of micro intelligent network construction, and form a standardized design and operational standards.

(2) Integration of smart micro grid and distribution network to realize the integration of two networks

The integration of smart micro grid into the distribution network is by no means a passive unit in the traditional sense, but really realizes the integration of the distribution network and micro grid. When the distribution network is introduced into the smart micro grid, the security of power supply can be guaranteed even in major accidents after the use of important load scenes. Therefore, this two-network fusion scheme is of great significance.

(3) Intelligent distribution network terminal

The revolutionary change of distribution network comes from the application of smart grid, advanced measurement system and advanced sensor technology. The management module of intelligent distribution terminal makes full use of the features of geographic information system, integrates the distribution management system and automatic maintenance system, realizes the routing, visualization, modularization and networking of distribution network management, and greatly improves the management efficiency of the power grid.

5. Conclusion

Under the strategic background of the country's vigorous construction of smart power grid, great changes are taking place in the power system all the time. Building intelligent distribution network is the inevitable choice of national energy sustainability. The strategy proposed in this paper effectively promotes the development of grid planning technology, and provides technical assistance for the stable, efficient and safe development of power system. It is the key link to realize smart grid and energy Internet. The future power grid will certainly be a dynamic situation in which micro-grid and hybrid grid coexist and various renewable resources are fully utilized. With the further development of technology, the advantages of the smart power strategy proposed in this

paper will be explored more and more, and more and more users will benefit from it.

References

[1]. Hamed Nafisi, Seyed Mohammad Mousavi Agah, Hossien Askarian Abyaneh. Two-Stage Optimization Method for Energy Loss Minimization in Microgrid Based on Smart Power Management Scheme of PHEVs[J]. IEEE Transactions on Smart Grid, 2017, 7(3):1268-1276.

[2]. Stavros A. Konstantinopoulos, Anestis G. Anastasiadis, Georgios A. Vokas. Optimal management of hydrogen storage in stochastic smart microgrid operation[J]. International Journal of Hydrogen Energy, 2017, 43(1):392-410.

[3]. Praveen Tiwari. A Review on Microgrid Based on Hybrid Renewable Energy Sources in South-Asian Perspective[J]. Technology & Economics of Smart Grids & Sustainable Energy, 2017, 2(1):10-23.

[4]. Xiaolong Jin, Yunfei Mu, Jia Hongjie. Optimal Scheduling Method for a Combined Cooling, Heating and Power Building Microgrid Considering Virtual Storage System at Demand Side[J]. Zhongguo Dianji Gongcheng Xuebao/proceedings of the Chinese Society of Electrical Engineering, 2017, 37(2):581-590.

[5]. Adam Milczarek, Mariusz Malinowski, Josep M. Guerrero. Reactive Power Management in Islanded Microgrid—Proportional Power Sharing in Hierarchical Droop Control[J]. IEEE Transactions on Smart Grid, 2017, 6(4):1631-1638.

[6]. Adel Merabet, Khandker Ahmed, Hussein Ibrahim. Energy Management and Control System for Laboratory Scale Microgrid Based Wind-PV-Battery[J]. IEEE Transactions on Sustainable Energy, 2017, 8(1):145-154.

[7]. Lingyu Ren, Peng Zhang. Generalized Microgrid Power Flow[J]. IEEE Transactions on Smart Grid, 2018, 137(99):12-17.

[8]. Chiu, Wei-Yu, Sun, Hongjian, Poor, H. Vincent. A Multiobjective Approach to Multimicrogrid System Design[J]. IEEE Transactions on Smart Grid, 2017, 6(5):2263-2272.

[9]. Zhuoli Zhao, Ping Yang, Yuewu Wang. Dynamic Characteristics Analysis and Stabilization of PV-Based Multiple Microgrid Clusters[J]. IEEE Transactions on Smart Grid, 2017, 274(396):128-152.

[10]. Marzband, Mousa, Azarinejadian, Fatemeh, Savaghebi, Mehdi. Smart transactive energy framework in grid-connected multiple home microgrids under independent and coalition operations[J]. Renewable Energy, 2018, 126(28):173-194.

[11]. Jacek Paziewski, Rafal Sieradzki, Radoslaw Baryla. Signal characterization and assessment of code GNSS positioning with low-power consumption smartphones[J]. GPS Solutions, 2019, 23(4):23-38.

[12]. QIU Xiaojie, AN Hong, CHEN Junshi. Energy Efficiency Optimization Scheme for Multi-core Processor Under Power Consumption Constraint[J]. Computer Engineering, 2017, 382(729):1154-1192.

[13]. Y. Yang, F. Xiao. The Output Side Power Quality Control Strategy for Microgrid Main Inverter under Nonlinear Load[J]. Transactions of China Electrotechnical Society, 2018, 33(11):2486-2495.

[14]. F. Wei, X. Lin, L. Chen. Microgrid Comprehensive Energy Consumption System Based on Phase Change Building Materials[J]. Zhongguo Dianji Gongcheng Xuebao/proceedings of the Chinese Society of Electrical Engineering, 2018, 38(3):792-804.

[15]. LU Jun, ZHU Yanping, PENG Wenhao. Feature Selection Strategy for Electricity

Consumption Behavior Analysis in Smart Grid[J]. Automation of Electric Power Systems, 2017, 41(5):58-63.