Saurabh Vishvakarma, 2022, 10:1
ISSN (Online): 2348-4098
ISSN (Print): 2395-4752

A Review on Fault Ride Protection of the Motor-Generator Pair System for Renewable Energy Systems

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Abstract-Based on power balance and stability of power grid, pumped storage power station plays an important role in modern power system. Motor-generator is the main equipment of a pumped storage power station. The fault rate and operation reliability of motor-generator is directly related to safe and stable operation of the power station and even the power grid. This paper summaries different types of faults with several examples of fault treatment of large-scale motor-generators, and puts forward corresponding countermeasures and suggestions, which provides a good reference for similar fault prevention and diagnosis.

Keywords- motor-generator, renewable energy systems, power systems, power grid, solar pv

I. INTRODUCTION

Solar cell systems or solar cell systems are power systems designed to deliver functional solar power through solar cells. It consists of many apparatus, counting photovoltaic systems that absorb sunlight or convert it into electrical power, photovoltaic systems that convert electricity from direct present to alternating current, or installation, wiring or other electrical accessories to build a functioning classification. It can also use solar cell tracking systems to recover largely performance of classification and include integrated battery solutions as the price of storage devices is predictable to fall.

Strictly speaking, a photovoltaic system includes only synergy of photovoltaic systems, that is, the visible part of the photovoltaic system, excluding all other hardware, and is usually summarized as the balance of the system. In addition, photovoltaic organization directly convert light into electrical energy or should not be mystified with other technologies, such as concentrated solar energy or solar heating for heating and cooling. The annual solar energy that India receives is equivalent to more than 5,000 trillion kilowatt-hours, far exceeding its total annual consumption.

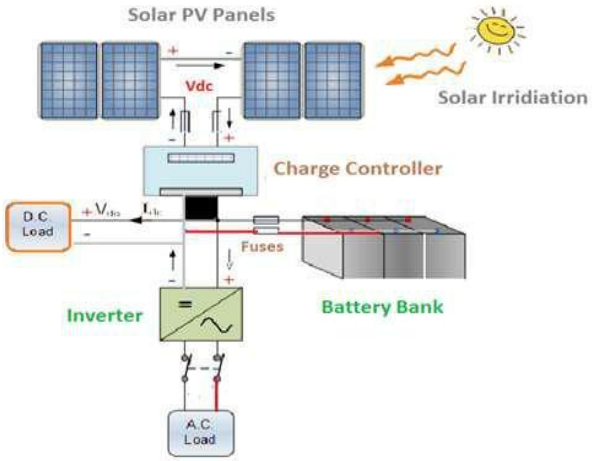

Fig.1 Solar PV stand-alone power system.

The global daily radiation is approx. 5 kWh / m2 day, and most of India's annual sunshine time is between 2300 and 3200 hours. Despite the low energy density and discontinuous availability, this abundant available energy can now be used very dependably for many purposes by converting it to usable heat or directly generating electricity. The conversion arrangement is modular or can be used appropriately for decentralized function. A typical photovoltaic independent system consists of photovoltaic systems and battery connections, as

International Journal of Science, Engineering and Technology

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shown in Figure 1. The array controls the load or indicts battery during day. The battery supplies power to load after dark. The inverter converts direct current of array or battery to 60 or 50 Hz power.
The array is segmented with separation diodes to improve reliability. In such a design, if a string in solar panel fails, it wills not load or short circuit remaining strings. Multiple inverters, such as 3 inverters with small ratings, instead of one inverter with a large rating. If such an inverter fails, remaining 2 can continue to provide power to the base load until the defective one is refurbish or replaced. The same propose method is also extended to use more batteries. Most independent photovoltaic classification installed in increasing countries supply necessities such as lighting, hot water or pumping.

Wind Energy Stand-alone System

Wind energy is the use of wind turbines to convert it into electrical or mechanical energy. The energy in wind is removing by letting it blow through moving blades that apply torque to rotor. The amount of power transmitted depends on rotor size or wind speed. Wind turbines variety from small 100-watt originator for private use to multi-megawatt machines used in wind farms or offshore. Smaller ones have through drive generators, DC output, aero elastic blades, and bearings or use blades to point at wind; while larger ones usually have gear drives, AC output, flaps and vigorously pointing at wind. Research is underway with direct drive generators or aeroelastic blades for great wind turbines or sometimes direct present generators.

Since the wind speed is not constant, energy construction of wind converter depends on capacity factor. A well-placed wind turbine has a capability factor of approx. 35%. In contrast, the distinctive capacity factor for nuclear power plants is 90%, coal-fired power plants are 70% or thermal power plants are 30%. In common, wind turbines are sensible when the average wind speed is 4.5 m / s or higher. Wind power is abundant, renewable, generally distributed and clean. Used to replace fossil fuels, it can reduce greenhouse gas emissions. When using wind energy at low to medium permeability levels

In a wind turbine system, the rotor is connected to a generator via a gear drive system or a Speed control system to generate power. Wind control is used in great wind farms on the national grid and small individual turbines that run rural houses or remote areas in the grid. For small wind turbines, generated electricity can be used to incriminate batteries or used directly. Larger and more complex wind power converters are used to supply control to grid., intermittent winds will not cause problems.

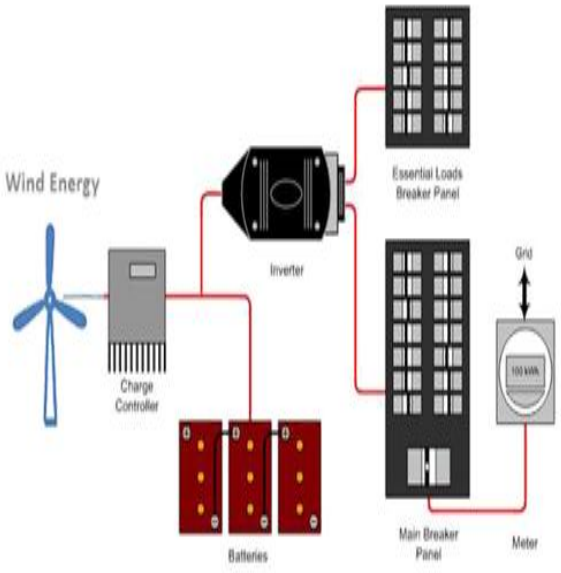

Fig.2: Stand-alone wind power system

Small wind turbines used for battery incriminate have a turbine diameter of 0.5 - 5 m and a power of 0.5 - 2 kW. Medium-sized turbines are used in small independent power grids mixed with diesel or solar cell systems. The diameter of these wind turbines is among 5-30 m or power is 10-250 kW. Large wind turbines are usually related to grid. This category includes diameters of 30-90 m or power of 0.5-3 MW.

A simple independent wind arrangement using a constant speed producer is shown in Figure 2. It has several characteristics comparable to a solar cell plant with solar cells. For small wind power systems that supply power to local loads, permanent magnet DC generators make wind power systems simpler and easier to control. On the other hand, instruction generators supply alternating current. The generator is excited by a parallel capacitor related to output terminal. The incidence is proscribed by calculating turbine speed. The battery is charge by an AC to DC rectifier or expulsion via a DC to AC inverter. The power issue of the load affects the steady-state and transient concert of instruction producer. The load control factor can be uniform, delayed or leading, depending on whether the load is resistant, inductive

or capacitive. Most of the loads on whole are inductive and have a delayed control factor.

II. RELETED WORK

ZHUO Mengfei et.al (2018) To improve the ability of fault handling in distribution networks, a coordinated fault isolation technique for relay protection and distribution automation was proposed. The configuration principles of relay protection and distribution automation co-processing distribution network faults are given, and the process of fault handling is analyzed. When the trunk line fails, the relay protection operates at the specified time, and then the distribution automation further optimizes and corrects it, so that the fault isolation is in the minimum range; the branch line fault relay protection can be completed, and the two do not affect each other. The static simulation system test shows that the co-operation fault isolation scheme of relay protection and distribution automation is feasible and isolates the fault area in the shortest time. Relay protection and distribution automation have significantly improved power supply reliability.

Zheng Zhang et.al (2018) Fault protection measures and interval positioning isolation methods are proposed for open-circuit faults of the constant current remote supply system, in order to realize the efficient and reliable operation of cabled underwater information network. Achieving the protection of the power conversion module in the trunk node by researching the protection circuit, and based on the controllable electrical switching type switch in the main node of the trunk, the system fault isolation circuit was designed and a new method of open-circuit fault location isolation was proposed. The research content has reference significance for the design and construction of cabled network underwater information network in the future.

Adil Ayub Sheikh et.al (2019) In this article, centralized protection system is developed for DC microgrid (DCMG). The novelty of the proposed protection algorithm is not only based on the combination of different fault location but also depends on the characterization of the faults. The protection system was developed based on the monitoring of voltages and currents at different locations within DCMG. On the basis of fault detection criteria, protective measures are initiated and appropriate switching signals are sent to the appropriate Solid State Circuit Breaker (SSCB) in order to isolate the faulty section. The 96V DCMG having ring configuration and its schemes for protection are simulated using MATLAB/Simulink environment. Simulation results shows that the proposed method works satisfactory in identifying fault in DCMG.

Yuxin Shi et.al (2019) It is easy to access electrical information of the all substation in intelligent substation, a backup protection scheme based on topology matrixes and differential zones is proposed. Firstly, topology matrix based on circuit breaker association and the differential zone is defined. Secondly, the action scheme of the differential zone is designed, and tripping matrix is formed. When a fault occurs in the substation, selective fault isolation can be managed through coordination and cooperation of each differential zone. The result of fault case analysis of actual substation shows that this scheme solves the problem of long time-limit of traditional staged backup protection and effectively improves backup protection performance, which is simple, flexible and reliable.

Guoxiu Jing et.al (2018) with the rapid development of power electronics technology, DC distribution network has technical and economic advantages in many fields and has great development space. In this paper, the topology of the DC distribution network with two power supply "hand in hand" is taken as the research object, and the protection configuration of the DC distribution network is discussed. By analyzing the fault type, fault detection, fault identification, fault location and fault isolation process of DC distribution network. The key problems and technical difficulties faced by DC distribution network protection are proposed. Finally, the future development direction of DC distribution network protection technology is prospected, which lays a foundation for subsequent research.

III. METHODOLOGY

Grid voltage disturbances lead to destruction of wind generators and solar system and they have to be dealt with by implementing a comprehensive fault ride-through strategy that can counter the adverse impact of all types of grid voltage fluctuations,

namely, symmetrical and asymmetrical sags, and symmetrical and asymmetrical swells. Currently, there is a lack of a regulation strategy that takes into account all the different types of voltage fluctuations in their design and execution.

There is also requirement for a smart reactive power management strategy that can support the grid according to the type of voltage disturbance. The proper regulation of reactive power will ensure that grid condition remains stable even during disturbances. Consequently, this will have a positive impact on grid reliability. There needs to be a comparative study of the harmful effects of the different types of voltage disturbances. This will give us an insight into the relative degree of danger that various types of voltage disturbances presents to the wind generator.

Hence, a more advanced ride-through strategy can be developed based on the study. This will increase efficiency of wind generator and solar operation. Renewable power components are mandatory to have a reliable fault charging capability to prevent major power outages in renewable energy production due to network failures. Since asynchronous generators are better able to withstand current power and capacity, one of advantages of connecting renewable power to a network through a power supply system (MGP) is the opening of these.Frequency feedback manage system block diagram of MGP system. a) MGP system with frequency organizes.

The quality of the present is "the widening of the spacing, current, frequency, and the proper operation of the user's system to collapse or collapse." The progress of electronic and electronic knowledge or uses of long-term equipment are attracting attention. Transmitting system parameters according to the basis of frequency shape is understandable Power system consists of large divisions such as power generation, transmission, distribution companies, etc. Power generation is a part of production of connected power plants. The transmission system is responsible for transmitting produce power to distribution site. The power allocation arrangement is responsible for distribution of the input feeder from the feedbox gearbox to the output center. Products can often be divided into profitable loads, household loads, manufacturing loads, urban loads or agricultural loads. The largest consumer of electricity in power plants is profitability load or manufacturing load. Cargo can be divided into unloaded goods and goods.

Industrial loads use the phase display controller PLC or motor driver arrangement where the device is malfunctioning. The nature of non-linear load provided by a pure wave source absorbs non-linear elements of current source and affects harmonics of cause elements.

The incidence of neutral elements reduces quality of electricity. With the increase in storage size of it is necessary to meet the requirements for building a power generation classification. The load is suspended and changes in the load cannot be predicted accurately. Sudden transform in the load can cause the system to retreat. The increase in type of moving load directly affects the output and working capacity of system. The drop in capacitive and inductive reactance affects power of structure. Sudden changes in capacitive deceleration increase the power at receiving end, or abrupt changes in inductive response reduce power at the receiving end.

The voltage change in the system is likely due to a number of causes in electrical arrangement, but voltage continuation nominal value is very important. An increase in power can damage associated equipment, but a voltage drop below rated value will reduce efficiency of connected load and shorten the life of equipment.

IV POWER QUALITY ISSUES

Users in major industries use the equipment connected to the system to recover quality of control or continue industrial control process. The impulsive characteristics of the electrical system and thore characteristics of related equipment can affect current quality, which is called the present quality difficulty [8].

- Interrupt
- Swell
- Voltage flicker
- Harmonics

motor protections

This part protects the protection of the synchronous motor, the input motor, the capacitors and the frequency converter motor. Unattended station motors must be protected in all non-destructive conditions. 1 Although the basic principles are the

same, the safety of small motors is not specified; this topic is defined in detail in National Electric Code. 3 The main motor methods describe here are at least the same as those described in manual, and are usually more complete. Though, check the code if necessary. The safety of the pump engine is not included here because it is fully defined elsewhere.

MPPT Algorithm-MPPT (Maximum Power Point Tracking) continuously adjusts the impedance detected by the PV system to turn the PV system into a PV system under changing conditions such as sunlight, temperature and load. An algorithm applied to photovoltaic power generation (PV) to keep it close. Engineers who make solar inverters use the MPPT algorithm to amplify power produce by a PV system. The algorithm monitors power to guarantee that the system is operating at the "maximum power point" (or maximum load) of power processing line, as shown below. MPPT algorithms are often used in the design of controllers for photovoltaic systems.

This algorithm allows a PV system to produce maximum electricity, taking into account various copies (sunlight) or temperature. Maximum voltage control is commonly used to increase power output in all situations of wind turbines and solar cell (PV) systems. This concept deals with solar energy, but it applies to frequently changing light sources (optical power transmission and thermal solar cells). The connection between PV system and the inverter system, external network, battery pack, or other load. However, regardless of the ultimate goal of solar energy, the main problem that MPPT solves is that the transfer efficiency of a solar cell depends on the amount of falling sunlight and the characteristics of the load on the solar panel.

.. As the sun's light modify, transmission characteristics that provide the highest power transfer competence change. When the load characteristics change, the efficiency of the system is improved or highest transmission efficiency is maintained. This load characterization is the most important point; MPPT is procedure of finding that point and maintaining the load characterization there. Circuits can be designed to convert any load power, current and frequency to solar cell according to different devices or systems, MPPT solves problem of choice. The maximum load supplied by the battery. Solar cells have a complex relationship between temperature and absolute resistance, producing non-volatile products that can be analyzed according to IV cycles. The purpose of the MPPT system is to test the output of the solar cell and apply a resistor (load) to get the maximum power depending on the ambient conditions. MPPT units are often integrated into power conversion systems and send various loads such as grids, batteries, engines, etc. to provide automatic conversion, filtering and control. Solar converters convert DC to AC, which can include MPPT. This types of inverter uses a resistor (load) to check the output power (curve IV) of the solar cell model and in particular to get the maximum control.

V. CONCLUSIONS

The large-scale motor-generator at pumped storage power station is large-scale electrical equipment. Three main factors affecting the operation reliability are design, product quality, installation and operation, etc. First of all, a good design review should be done, and all problems repeatedly emphasized in design liaison meetings should be treated seriously in the follow-up practice. Secondly, a good installation environment should be created. Acceptance check and test should be taken carefully. All problems should be solved in the debugging stage. Problems exposed in the operation must be traced to the root and targeted solutions should be adopted to solve these problems.

Finally, it is necessary to strengthen operation detection and analysis. For important parts, necessary on-line detection means can be properly configured, which will be conducive to timely detection of equipment hidden dangers and efficiency of fault handling will be also improved. Attention to the above key parts, failure rate of large-scale motor-generator can be effectively reduced and reliability of power station operation can be improved. This paper takes typical faults of large-scale motor generators in domestic pumped storage power stations as examples. Through analysis of causes and countermeasures of these faults, some references are hoped to be provided for safe and stable operation of the units that have been put into operation at present, and for design and manufacture of large pumped storage units in the future.

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