

Awareness On Microgrids And Various Protection Issues To Overcome In It

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ABSTRACT: As we know India faces problem of Power blackout every year due to the overloading on the main electrical grid. To avoid the above problem, Microgrids are the best solution. Basically, Microgrids are the small version of electrical grid. They are independent power system. Microgrids can be connected with renewable energy sources such as solar and wind. The use of renewable energy introduces the need of various storing devices and supplies it whenever required. Microgrids can provide wide range of applications in buildings, military camps and corporate/academic campuses, etc. They can have efficient and effective provision of electricity to “off-grid” areas as well as “keep the lights on” in times of crisis for critical applications like hospital. Though, Microgrids being so advantageous it has several technical challenging issues to overcome i.e. voltage and frequency control, islanding and its protection in Microgrids. This paper discusses the overview of Microgrids and issue to overcome in it-its Protection.

Keywords: Microgrid, Islanding, Distributed energy resources (DER), Point of common coupling (PCC).

I. INTRODUCTION

India's half of the power comes from coal-fired power plants, but it hasn't been able to get enough coal lately, which has driven up prices. Due to the depletion of fossil fuels in future, going towards renewable energy becomes important. To get rid-off from power blackout crisis, make use of renewable energy resources such as solar and wind for generation of electricity will be the best alternative. Microgrids are the best solution and can also be integrated with renewable energy sources such as solar photovoltaic (PV) array and wind power. Microgrid have capability to operate in both i.e. islanded mode and when connected to the main grid system. When Microgrid is connected to the system, it is viewed as a single aggregate load or source. The most important aspect in Microgrid is that it could provide a more reliable power supply to the customers when islanded from the system in case of major disturbance. This concept of Microgrid gives a new model for defining the operation of distributed generation. It consists of low voltage distribution system with distributed energy resources like solar PV array, fuel cells, and wind and storage devices like batteries, super capacitors and flywheels, etc. for operation of network. These systems improve power quality, reduce pollution and emissions and lower the costs of energy supply. Being so advantageous, Microgrids have three challenging issues to overcome.

These issues are voltage and frequency control, islanding and protection in Microgrid. This paper discusses about the protection of Microgrid. Its protection is necessary in both i.e. islanded mode and grid-connected mode. The basic principle involved in Microgrid, when it works under normal conditions that is without any failure it will operate as a grid-connected mode and when some faults or disturbances occur then it immediately disconnects from the utility system by the transfer switch at the point of common coupling (PCC) and operating in the islanded mode. Section 2 introduces the architecture of Microgrids. Section 3 introduces the overview of Microgrid with various advantages. Section 4 gives the difference between the traditional grid and future Microgrid schematically. Section 5 discusses the issues involved in Microgrid- Its protection and the conclusion.

II. MICROGRIDDIAGRAM

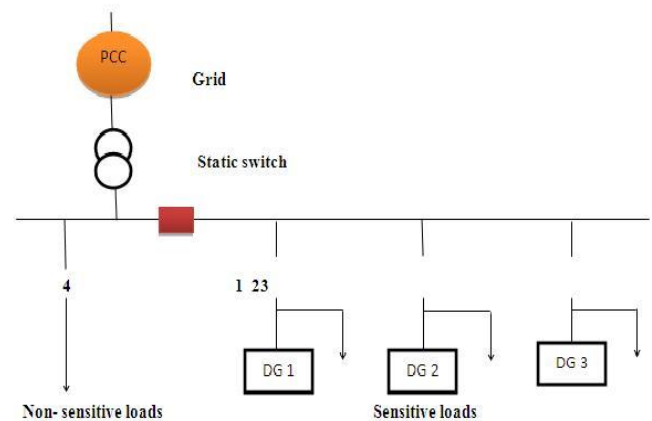


Figure 1

With the technology of new emerging energy scenario, the use of environment-friendly and of distributed generation units like gas, solar, wind energy, etc. are being used widely. Microgrid integrates control and load devices, storage devices, generators to a controllable unit. There is a point of common coupling (PCC) as shown in above figure between Microgrid and public grid that avoids the connection problem and satisfies user end's power quality. Above figure 1 represents the Microgrid architecture

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diagram. It consists of basic radial feeders that are, when source is present only at one end of the transmission line, which could be a part of distribution system. There is a single point of connection to the useful (utility) grid called the point of common coupling (PCC). Some feeders as in figure from 1 to 3 have sensitive loads, which require local generation whereas non-sensitive loads do not have local generation. Feeders 1 to 3 have the capability to island from the grid with the help of static switch that can separate all the 3 DG's control the operation using only local voltages and currents measurements. When there is a fault in the system while supplying power, the switch will be opened isolating the sensitive loads from the power grid. Non sensitive loads ride through the event. Generation of electricity is sufficient to meet the load's demand. When Microgrid in grid-connected mode, power that comes from the local generation can be supervised to the non-sensitive loads.

III. OVERVIEW OF MICROGRID WITH VARIOUS ADVANTAGES

Microgrid are independently controlled (small) electric

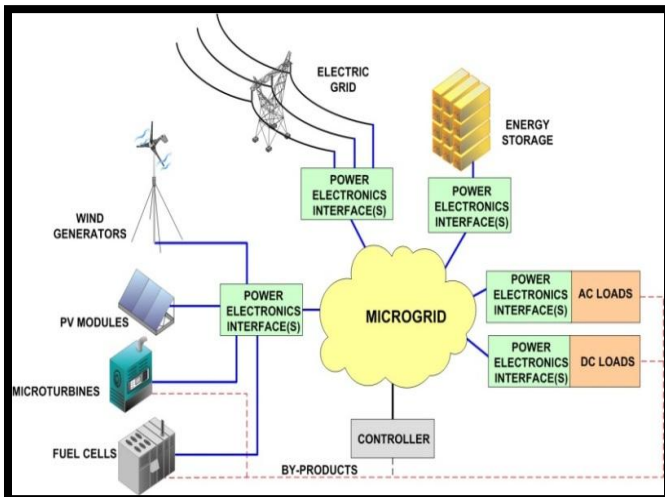


Figure 2

networks, powered by local units (distributed generation). The Microgrid with distributed generation (first approach) is shown in figure 2 above. Microgrid are considered to be locally confined and independently controlled electric power grids in which a distribution architecture integrates loads and distributed energy resources—i.e. local distributed generators and energy storage devices—which allows the Microgrid to operate connected or isolated to a main grid. Newer approach of Microgrid with distributed generation is shown below.

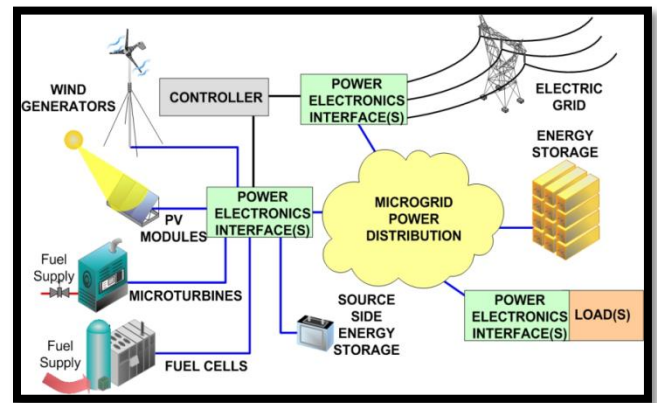


Figure 3

Advantages:

- In peak load periods it prevents utility grid failure by reducing the load on the grid.
- Environmental friendly by the use of low or zero emission generators.
- Operates in both grid-connected or islanded mode.
- Easier to control.
- More modular.

The Microgrid includes a variety of distributed energy resources (DER) units and different types of end users of electricity and/or heat. DER units include both distributed generation (DG) and distributed storage (DS) units with different capacities and characteristics. DG can be defined as “a subset of distributed resources (DR)”. DR is “sources of electric power that is not directly connected to a bulk power transmission system. DR includes both generators and energy storage technologies”. DG “involves the technology of using small-scale power generation technologies located in close proximity to the load being served”. Thus, Microgrid is electric networks utilizing DR to achieve independent control from a large widespread power grid. The various system components required by distributed generation are generation units i.e. microsources (PV modules, fuel cells, microturbines, wind energy), energy storage (batteries, super capacitors, flywheel), loads (main grid, electronic load) and power electronic interfaces (inverters, rectifier). General advantages offered by DER units are Redundancy, Modularity, Fault tolerance, Efficiency, Reliability, Easy maintenance, smaller size, Lower design cost.

IV. TRADITIONAL GRID V/S MICROGRID

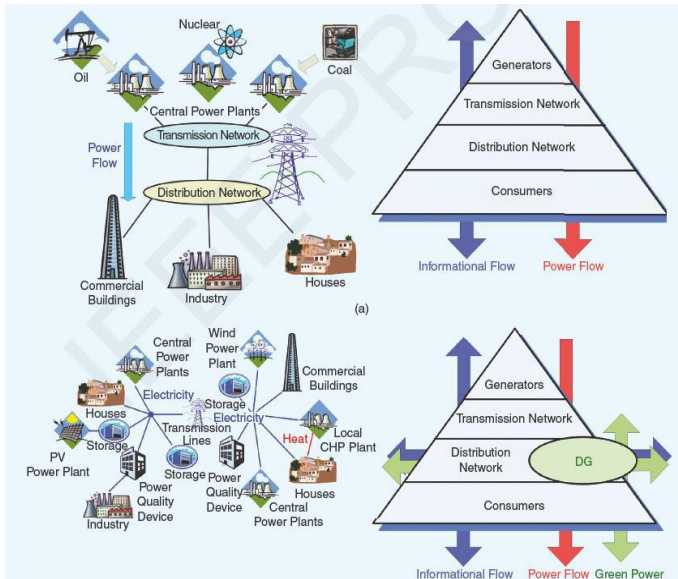


Figure 4

V. ISSUES INVOLVED IN MICROGRID – IT'S PROTECTION

Microgrid offering various advantages to the power supply (in terms of reliability and power quality) and to the end user's customer, on the other hand still some challenging issues are involved with Microgrid. Those are voltage and frequency control, islanding and its protection. Microgrid protection is the most important challenging issue. Protection of Microgrid means that lines, distributed generation, loads and lines on the island are protected. In Microgrid, operating conditions change constantly as Intermittent DERs, Short-circuit currents vary (both amplitude and direction) depending on MG operating conditions and availability of a sufficient short-circuit current level in the islanded operating mode of MG. These are various issues need to overcome in Microgrid.

VI. CONCLUSION

To avoid the transmission losses and to reduce the overloading on main electrical grid, please use solar Microgrids as solar energy is the best renewable source of energy and it is easily available. By doing so, we can reduce pollution on large extent and can make our environment clean and friendly. But, having so many advantages some technical issues like protection in Microgrid is still in research. Protection isolates the Microgrid from the utility grid as rapidly as necessary to protect the Microgrid loads. Protection isolates the smallest possible section of the feeder to eliminate the fault. So, protection is one of the most important challenges faced by Microgrid to use it effectively.

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