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Integration of DC Microgrid with Existing System

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Abstract: Modern trends of power circle are swiftly tending towards more sensitive form of energy generation to sustain the sensitive loads like electric-powered, commercial loads. By integrating the DC microgrid, we can increase the quality of power. DC microgrid has good use rather than AC microgrid. DC microgrid is the best solution to the raised problems like reliability, stability and efficiency of the existing system. That's why here we integrating DC micro grid for good power quality.

I. INTRODUCTION

Industry's framework and structure have become increasingly reliant on energy efficiency. It appears that every watt matter as energy expenditures have risen over the decades, and there has been a movement in mentality to reduce the ecological impact that individuals have on the environment. Everyone is able to obtain energy at a minimal cost. Everyone is just concerned with the cost of electricity, not with the amount of electricity wasted, and so on. [1]

A variety of issues affect electrical networks nowadays, which might contribute to poor electrical installation quality. As a result, many businesses are experiencing issues with power quality. People are willing to pay a premium to use renewable resources due to an increased awareness of the need to conserve natural resources.

The focus of energy harvesting has evolved from load to a global perspective, which also includes distribution efficiency and generation source. Electricity is the only commodity that motivates people to pursue their desires. As we all know, the majority of electrical power is created by burning the fossil fuels such as coal and natural gas, which release Green House Gases such as Carbon dioxide and other greenhouse gases.

Microgrids have gotten a lot of press in recent years because they provide major benefits to both energy users and power grid operators. Microgrid installations have been shown to enhance power quality, lower emissions, minimize network congestion and power losses, boost energy efficiency and reduce cost. The economics of the system could be improved. Microgrids can also save money by reducing the need for additional infrastructure. Microgrids are becoming increasingly important as renewable energy sources are integrated into remote communities. We use DC microgrid rather than AC microgrid because of its power efficiency. [2]

II. POWER QUALITY

The key concern of power generation providers has been power quality. By combining the existing system with a DC microgrid, we can increase the power quality. The main issue is the rise in power consumption in industrial and residential sectors. The demands for electricity put a strain on the power generation utilities' ability to meet it. A collection of electrical boundaries that explains about the proper functioning of a piece of equipment to is known as power quality. [1]

We need to promote renewable energy production, as well as thermal and nuclear power generation, to protect the atmosphere and provide power to all. With the aid of power electronic devices and circuits, the latest scenario uses renewable energy in combination with the utility grid. However, there is a lack of power due to existence of these power electronic devices and circuits.

Starting with environmental considerations, we lose control in the conversion phase when combining renewable energy sources with utility grids using conventional power efficiency topology. As a result, we must find a way to stop the conversion process and generate electricity using renewable energy sources.

Power that is of good quality saves both money and energy. Lower energy costs and reactive power pricing provide direct benefits to customers. Indirect savings are made by preventing situations such as Equipment damage and premature ageing, loss of productivity and data, and work loss. The capacity of the power gird to provide a clean and reliable power flow as a continuously available power supply is widely referred to as power quality. The power flow should have a pure sinusoidal waveform and stay within the voltage and frequency tolerances defined. Automatic resets, Data errors, Equipment failure, Circuit board failure, Memory loss, Power supply problems, UPS alarms, Software corruption, and Overheating of electrical delivery systems are only a few examples of problems caused by power quality issues. [1]

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III. WHY WE ARE GOING TO DC MICROGRIDS

The Direct current microgrid is formed by connecting the DC terminals to electronic loads, electronic vehicles, and batteries. Because of their power consumption, DC microgrids are preferred over AC microgrids. In terms of device performance, expense, and scale, DC microgrid has an advantage over AC microgrid. The overall efficiency improves because less number of power electronic converters is needed. Furthermore, since AC/DC converters do not need a transformer, the size of a DC microgrid is greatly reduced. [2]

In a DC Microgrid, there is no reactive power or harmonics in the system, resulting in superior power quality and system efficiency than in AC systems. [3]

Due to the economies of large scale power plants, the investment cost for Distributed energy resources is normally higher than for traditional energy resources within large scale power plants. DC microgrids have many advantages over AC microgrids, including more reliable dc load supply and lower losses due to elimination of multiple DC load converters, better integration of Distributed energy resources, and the elimination of the need for synchronizing generators. The size of the microgrid will be the most important factor in deciding its form.

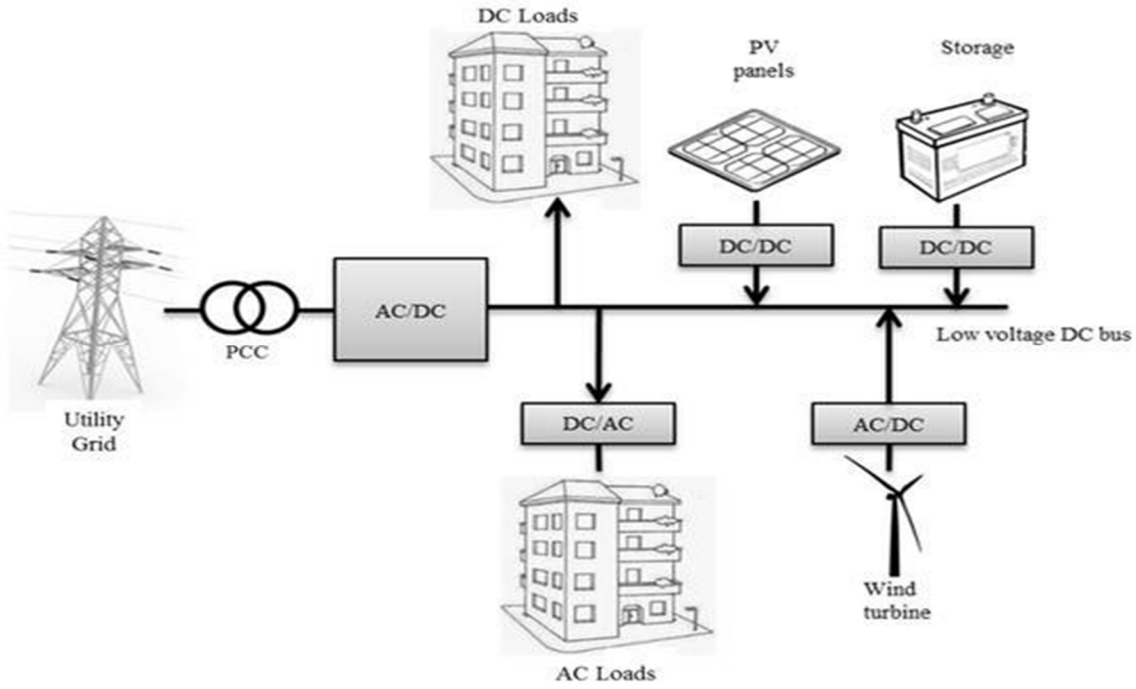

Figure-1: General Structure of DC microgrid

The general structure of DC microgrid is shown in above figure. In DC microgrids, threephase ac-to-dc rectifiers and transformers are required to link ac Distributed Energy Resources to the common bus, single and three-phase dc-to-ac inverters are required to supply ac loads, and a three-phase dc-to-ac/ac-to-dc converter, and a transformer are required to supply ac loads.
Connecting the microgrid to the power grid necessitates the use of a point, a common coupling switch.

IV. PROPOSED DC MICROGRID TECHNOLOGY

When compared to traditional alternating current systems, the DC microgrid technology suggested, offers considerable energy efficiency, cost reduction, reliability, and safety benefits. Onsite DC distribution generation and other DC loads are included in the DC microgrid architecture. DC microgrid technology, as shown, eliminates the requirement for the AC/DC rectifiers at the loads and decreases the requirement for the DC/AC inverters, which are now necessary to connect solar photovoltaics to the electric utility. [4]
Both DC/DC and AC/DC converters are used to connect the AC and DC components to the main DC bus in a DC microgrid. These converters must manage bidirectional power flow as well as disturbances like voltage drops and faults. Due to integration of modern

power electronic technology and the interaction with the AC network, the DC microgrid system is more complex than a standard AC utility grid. Several electronic devices will make up the future modern electrical grids. [2]

Figure-2: Configurations of conventional AC and DC Microgrid systems

V. INTERFACING OF DC MICROGRID TECHNOLOGY WITH THE EXISTING SYSTEMS

The following aspects are used to interface proposed DC microgrids with existing systems:

1) *High Frequency Transformers:* Transformers with a frequency greater than 50Hz can be much smaller than those with a frequency less than 50Hz. Higher frequency implies faster mmf fluctuations over time, resulting in higher emf production in coils; hence, for the same voltage, a smaller core area or fewer turns is required, resulting in a smaller volume. Transformers of this sort are mostly utilized in Switched mode power supply.
2) *Power Semiconductor Transistors and Diodes Advancements:* Advances in Wide band gap Semiconductor devices such as MOSFETs and Diodes, have sparked a quiet revolution in the field of power electronics. At higher voltages, Wide band gap materials like SiC have faster switching speeds and lower per unit conduction voltage losses. In comparison to converters composed of simple Si devices, these two features together result in a considerable reduction in power loss.
3) *Modular Converter with Multiple Levels:* For Photovoltaic applications, a multi-level cascaded DC-DC converter is utilized. The proposed system has the advantages of being self-contained, having smaller volumetric dimensions, and being more efficient.[5]

VI. CONCLUSION

Microgrids are being developed as a necessary for the integration of renewable energy sources into rural settlements, as well as an interim step toward the Smart Grid's implementation. The paper is about increasing the power quality by integration of microgrid with existing system. Power that is of good quality saves both money and energy. Lower energy costs and reactive power pricing provide direct benefits to customers. Indirect savings are made by preventing situations such as Equipment damage and premature ageing, loss of productivity, and data, and work loss.

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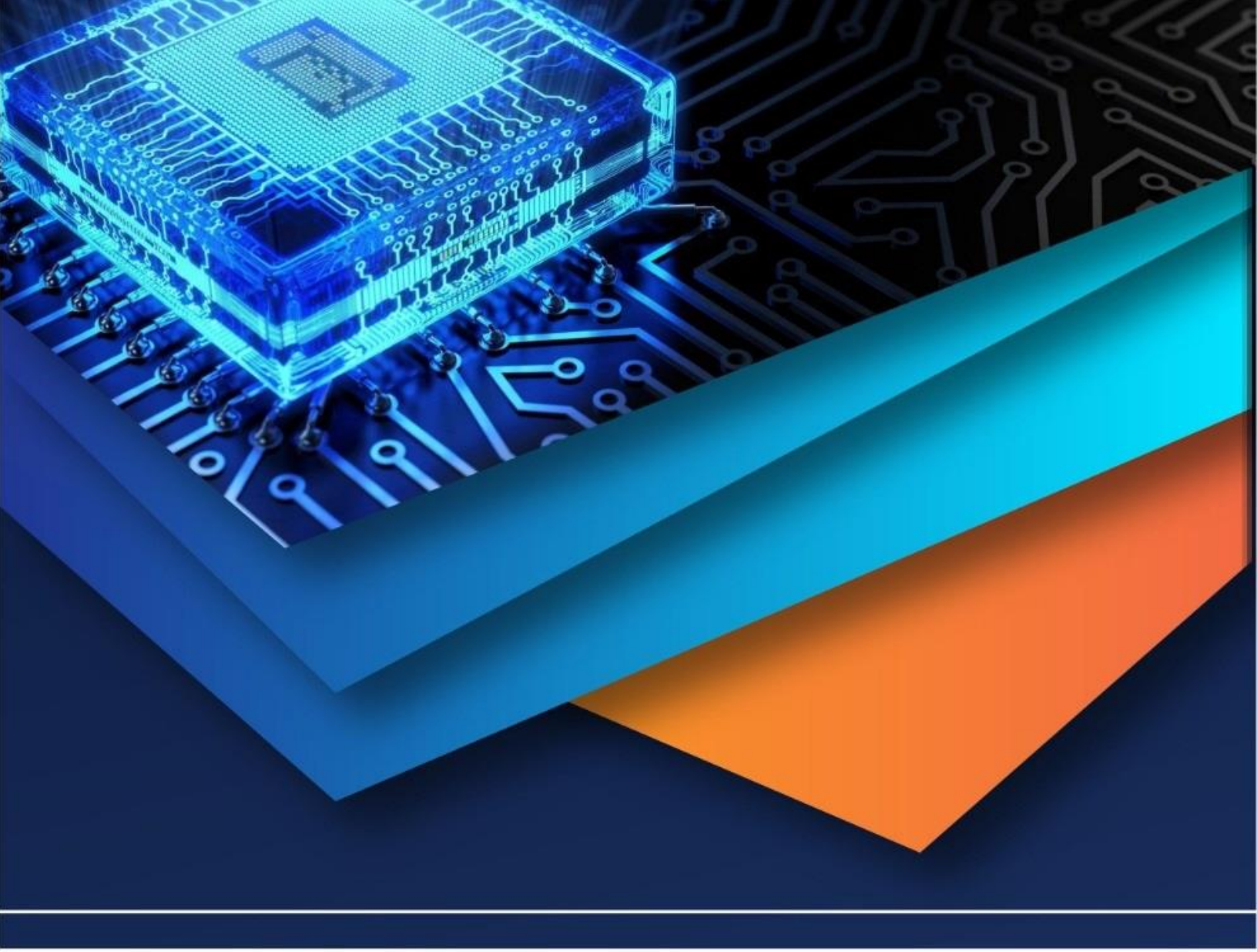

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