Analysis of Distributed Generation Systems

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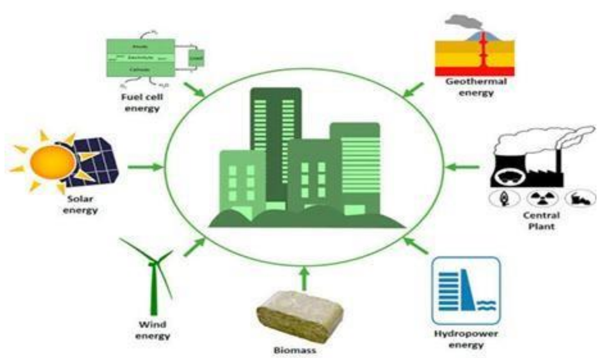
Abstract

Rapidly increasing electricity consumption and lack of generation and transmission capabilities have increased the trend towards distributed generation (DG). There is still no universally applicable definition of DG. This article discusses the various definitions proposed in the literature. Need to connect more DG system with

1. INTRODUCTION

The current electricity distribution system in most countries depends mainly on centralized generating facilities. These plants are installed far from the load centers. Although these plants are able to meet the demand of consumers, in some cases the production of a centralized power plant during peak hours can be enough to meet the entire demand. PO is able to accommodate excess demand during peak



hours. Distribution systems have a number of technical and financial implications.to the existing network system. This integration creates online or independent. Distributed systems include biomass-based generators, combustion turbines, thermal solar and photovoltaic systems, fuel cells, wind turbines, microturbines, motor/generator sets, and storage and control technologies.

This paper also summarizes the various effects of DG on the distribution system. Several DG research reports recommend the inclusion of distributed generation (DG) in power systems. Therefore, some countries have promoted the widespread installation of DG systems to make it competitive with the current electricity system. Although integrating DG into a distribution system is beneficial, improper installation on an existing system can cause some negative effects. Because electrical systems are not designed to contain power generation sources to the distribution levels, so the integration of the DG into the existing system will have some impact on the distribution networks. They can be classified into technical, economic and operational effects. Such effects must be carefully assessed and investigated prior to DG integration.

2. DEFINITIONS OF DISTRIBUTED GENERATION

In general, a generation organization is defined by its size and location, but some countries define distributed generation as having some key characteristics (for example, use of renewable energy, co-generation, non-distributable, etc.). Definitions of distributed manufacturing (DG) are not consistent in the literature, but different terms and definitions are used for distributed manufacturing. However, the following definition is generally accepted in the DG literature: "Generating installation directly connected to the network with distribution level voltage or on the customer side of the meter". In addition, terms such as distributed energy resources (DER) and distributed generation have been used in the literature, also in the context of DG. According to the Department of Energy (DOE), distributed power systems typically range from less than a kilowatt (kW) to tens of megawatts (MW) than the mains. The Electric Power Research Institute (EPRI) defines distributed energy sources as small generating units ranging from a few kW to 50 MW and energy storage, typically located near customer loads or distribution and transmission substations. Power plants below 100 MW are not centrally controlled in the electricity market in England and Wales. Therefore, the DG refers to any generating unit below 100 MW in this market. In Australia, generating units of less than 30 MW are considered a major unit. Several international organizations have also tried to define decentralized production. According to the Large Scale Electricity System of the International Council, the distribution electricity production can be understood as all production units with a maximum capacity of 50-100 MW, which are usually connected to the distribution network and are not planned or operated centrally. IEEE, on the other hand, defines distributed generation as the generation of electricity in facilities that are sufficiently smaller than central power plants so that connections can be made almost anywhere in the power system. According to the International Energy Agency (IEA), distributed generation is an electricity production facility that serves a customer locally or supports a distribution network that is connected to the grid at the distribution.

3. IMPACTS OF DG

A distributed generation system can use renewable or non-renewable generation sources and can be a grid-connected or stand-alone system. Due to low investment costs and small size, distributed generation plays an important role in power system planning. The introduction of DG into the distribution network can significantly affect the electrical and voltage conditions for customers and operating equipment. These effects can be either positive or negative depending on the operating characteristics of the distribution system DG functions. The positive effects are generally referred to as "systemic support benefits" and include: • Reduction of damages • Better electrical system reliability • Voltage support and better power quality. • Release of transmission and distribution capacities. • Delay of new or improved transmission and distribution infrastructure. • Simple and faster installation thanks to standard assembled components. • Cost reduction avoiding long time distance high voltage transmission. • Environmentally friendly if renewable sources are used.

As the number of distributed generation systems in the system increases, it also creates new maintenance and safety issues. These can be technical and financial and are discussed as follows.

4. TECHNICAL IMPACTS

DG Integration aims to overcome technical problems related to integration ensures high reliability of the system through distributed production. The next section provides an overview of the technical issues involved in distributed manufacturing.

A. Impact on electricity quality: depending on the perspective chosen, distributed generation can either improve or worsen electricity quality. Frequency is one of the most important power quality parameters. Installing and connecting the DG to the existing network will certainly affect the frequency of the system. DG can be a source of network harmonics. The resulting harmonics can originate either from the generator itself (synchronous generator) or from power electronics such as an inverter. Today, inverters are designed with Insulated Gate Bipolar Transistor (IGBT) technology, which uses pulse width modulation to produce an injected "pure" sine wave. This new technology produces cleaner power with fewer harmonics, which should meet IEEE 1547-2003 standards. The main purpose of the standards is to ensure that DG units do not have a negative impact on other customers or devices connected to the network. it refers to the connection of each generation with a combined capacity of 10 megawatts (10 MVA, approximately 10 MW) or less to the distribution network. Usually, when DG harmonic contributions are compared to other effects that DG can have on the power system, it is concluded that they are not such a big problem. Blinking is also an important force.

B. Effect on Voltage Regulation: Distribution system voltage regulation is designed based on predictable daily and seasonal load changes. DG power injectors change the direction of the power flow. At minimum demand and maximum output, the voltage level of the DG system at the load centers may increase beyond the permissible limits. Voltage regulators in this distribution system, such as step-down voltage regulators, tap changers and connected capacitor banks, may respond inappropriately.

C. Islanding: This occurs when a distributed generator (DG) continues to supply power to a location even when the power plant grid is down. Archiving can be dangerous for electrical workers, who may not realize that there is still power in the circuit, and it can prevent equipment from automatically reclosing. Islanding is not inherently harmful to distribution systems, and in some cases islanding is done intentionally for maintenance purposes.

- Economic Impacts:

One of the main obstacles to DG growth is the cost competitiveness of decentralized production. However, DG system costs vary greatly by technology. This section discusses the economic aspects of integrating a utility and its customers. Some key points are as follows.

A. High investment costs: Distributed manufacturing is less competitive than other traditional technologies. One of the most important remaining problems is the relatively high capital cost per kW of installed capacity compared to large central plants.

B. Low Transmission Losses: The amount of energy lost in the transmission of electricity is reduced because electricity is produced nearby. It is sometimes used even within the same building. It also reduces the size and number of power lines to be built.

C. Impact on electricity price: Distribution companies and large customers who buy electricity directly from the market can install their own DG systems to partially meet their electricity needs. Therefore, they buy less electricity from the grid and this reduces their costs. By installing larger DG units, market participants can withstand price fluctuations during periods of peak demand. The market price is affected by the ability of customers to choose between electricity from the network or from their headquarters, which leads to a decrease in the market power of production companies and control systems.

CONCLUSION

This document provides an overview of DG definitions and parameters that must be considered when integrating DG into power systems for the benefit of utilities and consumers. A properly installed DG is beneficial to the environment, the installed system, and is economically beneficial to the facility and consumers. Although distributed power generation can play an important role in meeting future energy demand, there are still some technical, economic and operational barriers that limit the adoption and use of DG. From a financial point of view, distributed generators.