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Effects of Distributed Generation on Electrical Power Network and Protection

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Abstract

The energy consumption increases day by day. To meet this need, we need to increase the generation of energy. Due to this growing demand, non-renewable energy sources come into play. One of these solutions is to connect dg to the electrical network. These distribution networks are usually connected to a low voltage network. The trend of the unidirectional force flow has gradually changed. The power supply connected to the electrical network is a bidirectional current flow system. The additional energy is returned to the network. The reliability has been improved. The introduction of the DG into the conventional power supply system poses several challenges, such as: higher short circuit levels, higher load losses, lower energy quality, voltage transients, voltage stability problems, coordination problems of the voltage regulation and protection, and the protection of the system may not work properly, and due to the bidirectional power flows of the DGs, there is a lower contribution of residual current from the DGs connected to the inverters. This article examines the effects of the penetration of DG into DN and suggests possible solutions to reduce these effects. In addition, traditional protection strategies are reviewed with respect to the Dg connected to the energy system.

Keywords: Distributed generator; Distributed network

Introduction

Generation of distribution is usually an energy generator that generates electrical energy and is connected to the load side. This allows the losses in a circuit to be minimized. This structure was also called a micro grid. The distributed generators include various types of power generators, such as synchronous generators, reciprocating engines, micro turbines, induction generators, fuel cells, combustion gas turbines, and non-renewable energy sources such as wind, sun, and tide scales with small classifications up to 10MW. It is a bi-directional power flow system. It fed in the excess energy through the installation of the new distribution network, linking a dg to the load side and reducing the cost of installation. Due to increasing energy demand, renewable energy generation is very competitive [1].

Generating distributions has many economic, technical and environmental benefits, such as connecting to the main network and providing independent loads. DG offers lower capital costs because it requires less time and less installation space. The DG in the networked mode has several advantages, such. These include, for example, improving reliability, securing the emergency in the event of customer disruption, improving voltage stability, and reducing the load for predicting future generation requirements. DG in networked mode offers energy savings at maximum shave. The maximum shave is a method that reduces the consumption of electrical energy within the maximum demand of the energy system. Inserting dg not only has benefits, but it also has some impact on the performance of the system, such as the effects on the short circuit level, the transient stability of the system, the voltage and the quality of the energy. The presence of DG provides an additional fault current in the system. The value of the fault current depends on the parameters, e.g. B. size, type and location of the DG. These additional fault currents affect the performance of the system protection. This document gives an overview of the impact of the GD on the energy system and its impact on the protection of the system. And investigate possible and effective solutions for the reliable functioning of the distributed network [2].

Types of Distributed Generator

Solar

The production of solar energy is one of the fastest growing and most promising renewable energy sources in the world. Solar energy is the conversion of solar radiation into electricity through the use of photovoltaic solar cells. This conversion takes place in the solar cell by photovoltaic effect. Normally, inputs are generated in the MW range. The power of the solar panel is converted into alternating current by the inverter.

Wind turbine

A wind turbine uses the wind as an entrance. To turn this turbine, actuate a primary motor connected to the shaft a Generator. The generator provides an AC output voltage that depends on the wind speed. Since the wind speed is variable, the generated voltage must be transferred to DC and back to AC using inverters. The range of wind energy generated by wind turbines is several megawatts per turbine.

Fuel cells

The operation of the fuel cell is similar to that of a battery, but it is continuously charged with hydrogen, extracted from any hydrocarbon source, this is the charge of the fuel cell together with the air (oxygen). The fuel cell uses the reaction of hydrogen and oxygen by means of an ionic conductor electrolyte to produce an induced DC voltage that is proportional to the number of fuel cells.

Micro turbines

The micro turbines are based on the technology of very fast rotating turbines together with a generator to generate a high frequency voltage output. These micro turbines are usually powered by natural gas.

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Rotary machines

Rotary machines are types of DG that include induction or synchronous machines such as induction and synchronous machines

Synchronous generators

These machines use fuel as input to generate electricity, with different classifications from KW to a few MW. Rotary machines are mainly used as stand-alone systems or as backup generation systems [3-5].

Effects of Distributed Generation on the Electrical System

The insertion of DG in distribution systems has several implications. In that. These effects can have positive or negative effects. System and can be considered as the system advantageously and disadvantageously distributed. Generation this part looks at the impact of the GD Different features of the network [6].

Voltage regulation

As the DR units are added and added to the distribution systems the capacity accumulates up to a significant part of the total fee of the collection.

The coordination of DR with the regulators of the distribution system wills extreme important in radial distribution system the main regulator. In the substations, the on-load transition transformer method is used with additional line controllers in distribution and switched; Condenser feeder several possible interaction types. They exist depending on the type of DR and its control configuration. In addition, the presence of DR directly affects the voltage. Profiles along a feeder change direction and size from active and reactive power flows. And it also affects the stability of the system. The loss of system stability affects the effectiveness of the standard voltage control technique. Directivity Voltage control loops should also be considered [7].

Harmonic

A harmonic distorted wave is a wave that does not follow a pure wave Sinusoidal pattern. The generated harmonics may originate from the generating unit in itself (generator) or from the power electronics. Like the inverters with which the generated shape was transferred from Current from DC to AC to be fed into the network. In the previous days, the investor is based on high SCR harmonic levels, while the new inverter technology is based on the operation of IGBT (Insulated Gate Bipolar Transistor) with the technique of pulse width modulation in the production of "Sine wave" generated. The generating unit also generates harmonics due to the presence of the non-linearity in the transformer excites the impedance or loads such as Fluorescent lamps, AC to DC converters, variable Frequency converters, switching devices, electric arc furnaces, Welders and other equipment. The installation of DR may be in some in some cases, the harmonics in a public service distribution system acceptable for disturbing values [8-10].

Short circuit level

Impact of the DG on the short-circuit levels of the network The penetration of the GD into a network has a direct impact on the EU Short circuit level of the network; causes an increase of Error currents compared to the normal network Conditions in which the substation is the only generation unit. This increase is also achieved when the GD is small Production capacity DG's contribution to the defaults. This depends on a number of factors, such as the generation capacity of the DG (size of the DG), the removal of the error from the DG Place and type of GD [11].

Sags and swells

Falls, floods and short-term interruptions are short-term fluctuations. In the system voltage, this is usually associated with errors. Switching large loads or starting or stopping motors. And other large equipment can also cause sagging and swelling. Sinking, inflammation and other transients can be extremely harmful sensitive customer equipment under certain circumstances. The DR can cause such transients when a large capacity unit is turned on all at the same time or the number of units is switched on simultaneously or a resource is brought online before it is synchronized with the network. These events can cause the conditions outside of the step to change Devices that can cause inappropriate mechanical stress in the device Equipment that leads to damage [12].

Power quality

Different Dg has different properties and therefore creates different energy quality issues. Increasing the power failure rate by adding power often results in better energy quality. The notable exception is that only one argument dg. The E.G wind turbine in a one-week network can lead to energy quality issues, especially during start-up and shutdown. Excessive use of power electronics and advanced controls results in energy quality issues, and these devices are very prone to power quality issues [13].

Impact of Distributed Generation on Protection

False tripping

Wrong deduction of the collection If the DG is connected to a distributor, this can happen cause a wrong trigger in a healthy feeder. When the error occurs at a neighbouring branch then the fault current is contributed DG connected to this feeder. If the fault current has contributed the values are higher than the rating of the protection device and then error free the feeder is also out of operation until the fault in the device is resolved defective feeder [14].

Nuisance tripping of feeder

The annoying trigger is called a DG break of public sector circuit breakers for outage outside their protection zones. Due to power surges in the GD, disturbing trips can occur installation or faulty outside the installation of the GD. Power Discharges in a distribution network is caused by the loss of large loads like engines in the presence of a DG. Great load loss this can lead to too much energy being exported to the network to shoot a squadron. In the same way, the failure can also take place outside the protection zone Annoying causes for burning production units. This can lead to one sudden loss of DG generation [15-17].

Blinding of protection

The blinding of the protection refers to the desensitization of the delivery. Relay in a fault condition due to the connection of DG to a Distribution feeder. If an error occurs in a feeder with DG Connected with this would be a residual current contribution, both the DG and the network. The contribution of the failure depends on Network configuration, network impedances, size and location of the DG. Substation can lead to a reduced residual current contribution of the network and can increase the overall fault current. Because of reduction of the fault current; it may happen that the fault current is seen the starting current never reaches the relay. Then the protection The system based on the principles of the over current relay may not work due to the reduction in the contribution of the network until the unit

of the DG shoots down. Thus, the DG can make a relevant contribution to the fault current affect the sensitivity of the protection system, which can lead to it serious consequences in the electrical system. To mitigate this type operating conflicts by adding DG, relay settings of the power relay should be reduced after adding DGs to the same feeder [18].

Neutral shift

The neutral change occurs when the distribution system becomes No earth connection after disconnecting the power switch due to a Failure of a single line to earth. This is mainly due to Connection transformer when the transformer has been used The DG interface with the utility has a triangle or no wye star Connection on the supply side, then this neutral change can take place Cause overvoltage in the other phases without failure. This one here the overvoltage in the other healthy phases could be 1.73 p.u. This one here It is a serious consequence that can harm the customer. Equipment and can cause safety hazards. A Lightning conductor is normally used to protect customers selected place [19].

Unintentional islanding

The formation of involuntary islands takes place in a distributed network. If DG is connected due to a feeder failure or Maintenance purpose and because of this part of a power the system is disconnected from the network and fed by the GD. This Island is generally avoided when used impermissible limit for operating voltage, frequency and power [20-22].

Conclusion

Distributed generation has a greater impact on energy loss, voltage fibrillation, harmonics, short circuit, and island and network protection. Decentralized generation offers many advantages, including the generation of electricity close to the point of consumption. The energy supply is increasing due to the variety of energy sources, the reduction of energy losses in the network, resulting in a more competitive energy market, the resources used are renewable and the energy savings. Emissions of greenhouse gases, in particular carbon dioxide from the burning of fossil fuels. While these and other additional benefits are clearly identified, distributed generation and distributed energy resources are not always economically viable. Its viability is closely linked to energy prices and measures taken by the national government to promote decentralized generation energy resources. However, the benefits of distributed generation will be widely accepted in the near future.

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