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Original Article

Effects of Dispersed Production Sources on Distribution Network

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ABSTRACT

The production of energy is not a new term scattered. The traditional structure of the electric power industry has always been based on the absence of active electrical energy production resources in a distributed network, has been based. By increasing the amount of installed capacity, production and these resources because of the different technologies in the construction and use of productive resources, the effects of such resources in parallel operation and connect them with the distribution network to prevent degradation of power quality, reliability and the ability to control the distribution network is very important.

Keywords: Network, Distribution Production, DG.

Introduction

The production of energy is not a new term scattered. The start of the days when their need for human handling, to a variety of energy needs, the production is sporadic, because this is the place to stay near the energy consumption is produced. Dispersed production locally is used. Given that these are close to centers of consumption products, there is no need to transfer electrical energy output in the long haul there. The more the consumer is closer to the manufacturer; the electrical energy supply costs also will be reduced. The topics and issues have caused sporadic production as an appropriate choice for production and consumption demand is raised to increase accountability. Research carried out by research centers such as EPRI results represent an advantage over electrical energy production by production in the year 2010. As well as this figure to 30%, according to NGF research also has been announced.

A variety of distribution network structure

The voltage levels in the distribution system of Iran

Voltage levels in both distribution networks and LV section can be divided into low voltage. The output of the network, either in post 66-63 and 132 kV distribution system of start and termination shall be members of the cargo. Medium pressure network in rated voltage levels with 20 and 33 and 11 kV voltage

levels low voltage network with 380/220 MV, respectively.

Types of structured distribution networks

The whole structure of the distribution networks for the categories is the following.

Radial structure (a hand-fed)

In this type of network a few lines of the post and any of the other lines are separate lines to reach consumers. In this type of structure, either with a path of nutrition bars, and any money in an electrical load are caused. This structure is shown in Figure 1. The most important is that the structure of this defect is at the end of the line, especially at peak times, it is a significant voltage drop. But with low costs and benefits such as design and operation is simple: this type of structure is mainly used in low voltage networks and in particular in cases of medium pressure networks such as remote and rural importance such as usage time may be used for this type of structure.

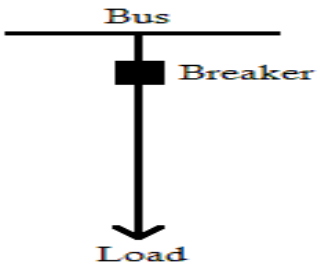

Figure 1. Network with a radial structure

RIM structure (from double-feeding)

In this type of structure, the path of either feeding repeatedly or if in any way, then the other one is to route the route cannot be cut an electrical load (Figure 2) very high reliability advantage of this structure is. This structure has a very high cost and design such as clique wielding power and exploitation is more difficult. This type of structure due to special cargo and rarely feel only for use in medium pressure networks will be.

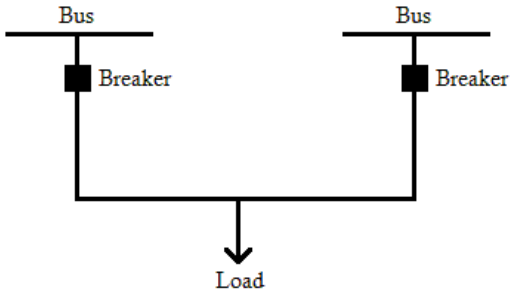

Figure 2. Network structure with rims

The open structure of the rims (rims, but network utilization radial)

In this structure in the path of a normal diet over balloting but also for the remainder of the route they have taken is that if you do it in the path of other switching times, will be live. The benefits of this high reliability and cost structure are lower than the rim can be named. But the more difficult the utilization structure of disadvantages it is. This structure is used in medium pressure networks and in networks for low voltage up to take this restriction allows voltage drop structure is used. This structure is shown in Figure 3.

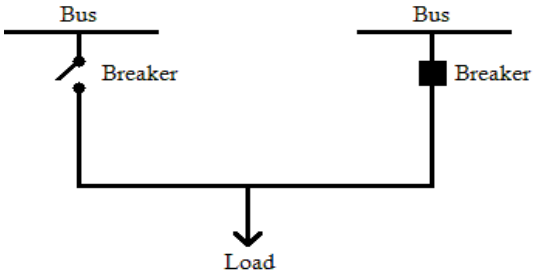

Figure 3. Structure of the rim with open network

The structure of the screening (from a few hand-fed)

In this path of each structure shall be fed and therefore has a very high reliability, respectively. The disadvantages of this

particular design, structure design, very difficult and complex protection system it is. This is a type of protection structure of fuses and mainly used in low voltage networks process. This structure is shown in Figure 4.

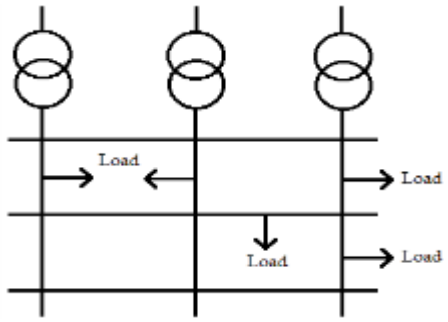

Figure 4. Network structure with screening

Double radial structure

In this parallel path between two bus bar structure and located in normal times is only one of the two routes is closed and the other as the reservation path. The problem with the creation of the measurements in the path of one of the other direction it is feeding time. The main advantage of this structure is very high reliability of this method, respectively. But the high cost structure is equipped with super. This type of structure is used for medium pressure networks. This structure is shown in Figure 5.

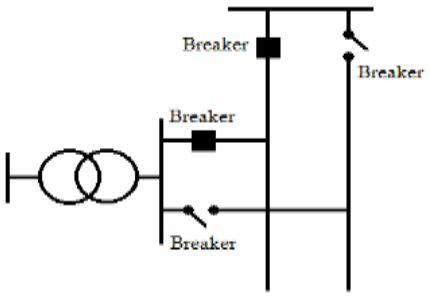

Figure 5. Double with radial structure of the network

The structure of the distribution networks in Iran

The main cargo on medium pressure networks for feeding and open rim small cargo and low importance and Outland (e.g. rural areas) are fed by radial. The bulk of Iran's low voltage distribution system (60-70%) for radial and everything else they are feeding in the open rim. Usually the main feeder has a distribution network that is lateral to the LAN are radiating. The impact of DG on reliability of distribution network DG can be applied in the following by the distribution network reliability to improve the distribution network:

1. Adding production capacity in continuous manufacturing taking place, be and as a backup storage
2. The free part of the transmission and distribution capacity
3. Prepare care and maintenance of the power system, with temporary backup power generation. DG can also be specified at the time of the Act, such as a courier or times of extreme atmospheric events (time that the possibility of more electric power transmission is cut off).

As well as other important features of DG is

The DG unit can be made independent of the network (the performance of an island) or parallel to the network as well as a combination of both methods mentioned Act. Combining the two methods means that in case of an error in the DG network separates the network and independent (the performance of an island) to be used for the production of the consumer to continue.

The impact of DG on low-voltage distribution network

In the distribution system with the passage of time flow resistance and impedance lines can be created in addition to the losses, which the voltage drop with increasing load and radial structure due to

this system the network endpoints is getting worse. Traditionally, low-voltage distribution system to be controlled:
control of voltage pulses by altering the Trans in posts
parallel capacitors with reactive power control
The presence of DG in distribution network for the control of voltage can be checked as follows: two perspectives If the output does not change with time, i.e. DG with the increased load, and also increase the production of DG by reducing production times reduced. In this case DG for negative times and reduces the voltage changes. But in some types of photovoltaic and wind power plants, such as DG of this possibility does not exist, and the network voltage changes can be high. The DG's performance can be found in the following two modes also check out:
- Lack of voltage regulation mode
- Voltage regulation mode
In a State of lack of voltage regulation in any functional, DG to improve voltage regulation in power system do not in this case DG only be about constant power factor and voltage generated due to the impact of the changes to be injected by the DG. In this case the output voltage can be increased with increasing active DG finds. This increase can lead to voltage in the network to be improved. But on the other hand increase too be injectable on behalf of the DG to the system can lead to increased nominal voltage of the voltage increases and causes the system undesirable. In terms of voltage regulation, DG has always been to act in such a way to be undesirable in certain limit voltage try to persist. Because many are small DG systems (inability to supply enough reactive power) little impact can have network voltage regulation as well as a solo performance is difficult to coordinate with any equipment, the DG performance tuning voltage on the DG to DG performance mode to be isolated from the network to be preferred where DG, the whole time alone nourishes and the need to adjust the voltage can be felt by the DG.

The impact of DG on the protection of the network

Protective relays, one of the most power systems are the equipment. The task of this error detection relays up protection system, seen in the smallest error is part of the district with the highest speed of the isolated network. With the presence of DG in distribution networks, especially when production of more feeders can be, the DG of a stream can be sent to the post. It means that the network is not designed for that situation, goes. In this case the reverse flow rate be in protection, acts to false. Because it is in an error mode without the DG mode, only to be found can be reversed. In this case should be set so that protection system between the DG and the error can be like a short circuit and the difference keying. For example, the harmonic component can be used to detect the use scenarios. Also, for your protection and DG at the time of short circuit most standards separate DG of the network suggest. Another important impact of DG on the protection effect of protective system is added. Set the value with the added protection of a stream flow DG will change and will be more difficult to coordinate protective system. When a number is added to the network must have DG coordination between network protection and appropriate protection must be established in the DG, unit. Therefore, a number of important considerations in this regard include:

-DG unit normal protective dysfunction should not create network.

-DG unit should not be fed on the network, when the main power supply has been disconnected network continue.
-The protection unit, DG, should not be to short circuit related to the other areas of the Act network. One of the most important problems for all types of DG this is a short circuit in the adjacent feeders may cause unwanted trip unit is in the DG. The reason is that in the low-voltage network in all the feeders when a short circuit occurs will drop. The range of high voltage drop and performance time relays can be short.
Generally, the problems created by dispersed production sources, distribution networks for protection include: the wrong the wrong trip productive units, feeders, becoming blind protection, increase and decrease the level of unwanted short circuit, being an island, avoid the automatic open and close and open and non-sync. The emergence of these problems to disperse production and network profile will depend on the resources and in most cases, to avoid this; you must change to the overall network protection. This change may be very complex protection plan, why should the entire system, including network and DG are model, so that the best protective scheme is still very remote regions scattered production units after connecting, the other radial system will remain and this means loss of synchronization between the protective equipment is. The extent of the effect on the size of the coordination, DG Enterprise type and location depend on the DG.

The impact of DG on distribution system power quality

The most important impact of DG on distribution system power quality, harmonic impact is on Flickr. The main cause of the rapid changes created a Flickr stream time is coming. In the presence of DG in addition to rapid changes of times, quick production changes could also be causing the Flickr. This problem especially in the case of wind power plants according to their capacity there. The main reasons for the creation of the DG in distribution network the Flickr can be expressed as follows:
1. To start a big unit
2. Large and sudden changes to the output of the DG
3. The interaction between DG and voltage controller on the feeder equipment
Of course, in cases where DG of power electronics converters they use, can be used with flow control when you begin working to improve the DG. The cause of creating a harmonic in the presence of the network coming non-linear component. The presence of harmonics in a network is undesirable for the following reason:
Harmonics in power system losses, and they increase in subscriber equipment.
Harmonic sometimes may stimulate the sensitive loads or equipment they control.
The harmonic major domains of life, the network equipment are reduced.
Power electronics equipment to connect the network to the DG process can generate harmonics are. Domain and rank these harmonics are operational and converter technology fashion it depends. Today, with the arrival of IGBT and allow use of higher Harmonic frequencies produced by the carrier, power electronics converters has fallen sharply.

The impact of DG on the short circuit power network

The presence of DG in distribution network will increase the flow to be error. The following factors have an effect on the flow of error depends on.

DG technology

DG performance fashion
How to communicate with the network before connecting the system voltage short Of course, due to the high impedance of the distribution lines, with a move away from DG, error flow speed is reduced. In table 5 the DG Terminal error flows based on the connection technology has come.

Table 5. Terminal error DG flows based on the connection technology

Terminal error stream in the form of a percentage of nominal flow	Generator connection technology
100 – 400	Inverter
100 – 500	Separate excitation generator
500 – 1000	Synchronous or asynchronous generators itself

The conclusion

Depending on the network and the type of attributes scattered production sources, the above effects can be positive or negative results to be followed. Among the positive results caused by production sources, distribution network scattered connection especially radial distribution network, can be used to improve the quality of electric energy, reducing network losses, release electrical energy transmission and distribution capacity, falling to delay plans for the construction of costly new power plants and lines and improve the reliability of the system, pointed out. Achieve all the above positive results in terms of technical, very complicated and difficult. Because this requires having a dispersed production sources with high reliability, controllability, and having the capacity and the right installation location on the network. In addition to the various other criteria should be utilized in conjunction with them, such as factors to be considered, the amount of allowable voltage and current harmonics injected to the network capacity, restrictions, safety issues, network security, performance, State of the island caused by the power cut from the network by keys and protective relaying and production units continue to work in an area.

The existence of these issues, principles, criteria and specific studies before connecting the significant capacity of dispersed production sources to the electric networks, the essential. In these studies the special profile of the network and its load consumption patterns should be considered. Analytical studies of the effects of dispersed generation on distribution network must be in order to compare the behavior of the system before and after connecting the network to produce scattered resources.

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