Analysis of Micro grids on Protection Issues and Technical Challenges: A Review Paper

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Abstract **- The ever increasing energy demand leads to the integrating of distributed energy with the grid. The advancements in the new technologies, in accordance with the customer demands the DG integrated with the micro grids plays a major role. Thus it provides the better quality of power and reliability and ease of access at the consumer end. This paper mainly discusses the protection and control strategies of micro grids and the technical aspects included with DG and the island mode of operation.**

Key Words **- Distributed generation (DG), Micro grid, islanding operation, control strategies, protection issues.**

I. INTRODUCTION

The term micro grid and the operation of the power system network including micro grid implies from last few years. The concept of DG and micro grids impact effectively due to benefits at the consumer end premises. It is one of the best solutions in the energy crises in the developing countries like India. Basically it improves the service quality, power reliability at the consumer sites. Micro grid is a small compatible network comprising of DG, storage units and the controllable loads.

II. DEFECTS OF DISTRIBUTED GENERATION

The power system of centralized power, long-distance power transmission and large power grid interconnection is the main mode of the production of electric energy, transportation and distributing, is to supply power to consumer ends. In large-scale power grid local accident easily spread, small disturbance fault at any point of the generated will be greater impact on the whole power, resulting in a large area power outage, or even the whole network collapse, while The larger power system, the higher the probability of the accident. Large power grid vulnerable to destruction of war or terrorist forces, serious will endanger state security. Changes in large power grid cannot be flexibly tracked of power load change, such as a surge of air conditioning load in summer causes power supply short deficiency, in order to short-term peak load to build power plants and transmission facilities huge cost, very low economic benefit, with the continuous increase of load peak valley difference, load rate is decreased year by year; the use rate of power facilities has a downward trend.

III. THE ADVANTAGES OF DISTRIBUTED GENERATION

A) Energy saving-In the current background of building a conservation minded society and promoting energy-saving environmental protection, distributed generation can be said to be a bright star of electric power industry, once the face of international development in distributed generation can be seen: the country of the higher energy efficiency and better environmental protection keener support for the development and application of distributed energy source technology, and support policy more clearly. There are two obvious difference between the traditional power grid and distributed power supply: first, the distance of traditional large power grid and electricity load is very far, usually to input to give user remote, especially in China, large power distribution is extremely uneven, electricity consumption of long-distance transmission is very considerable, and distributed power supply is closer to the user site, thus the net loss decreased significantly; second , the form of the traditional great power supply mode is single, and distributed power supply can provide various forms of energy, typically cold, heat and power cogeneration can achieve three energy cascade utilization. In line with the "temperature counterparts, cascade utilization" principle, thus greatly improves the overall efficiency of energy use.

B) Reduce air pollution-Air quality is closely linked with our life quality, air pollution is in large part from the various fires power station, in our country at present, and the efficiency of thermal power generation in the world is not high. Raw material of distributed power generation is using natural gas, oil and other clean energy and wind power, hydro, tidal, geothermal and other renewable energy, to reduce carbon dioxide, carbon monoxide, sculpture and nitrogen compounds and other harmful gases emissions, at the same time, because the voltage class of distributed energy system power is relatively low, the electromagnetic pollution is much smaller than traditional set Chinese generation.

C) Increase the economy of power grid-Using the technology of distributed generation, the demand of the new centralized power plants and long-range transmission lines will be reduced less. First of all, the large of new load will meet by

distributed generation; secondly, because the distributed may cut a peak and fill valley load, balancing power, the use rate of existing power generation and transmission facilities will be greatly improved, the some utilization rate is extremely low, only to meet the need of the peak load generation and transmission facilities will no longer have the necessary construction. Thus greatly enhance the network economy. In addition, the distributed generation can also be used as a backup power for peak load Provide power, not only to improve the economy of power network, but also improves the reliability of power grid operation.

D) Reduce line loss-Because distributed generation can be used as a local power supply, so the transmission and distribution loss is very low, not only saves the construction cost and investment of power transmission, but also can reduce the power consumption of the long distance transmission lines. In addition, we also can real-time monitor the quality and performance of regional electric power, to further reduce the loss and improve power transmission efficiency, very suitable for mountainous rural and pastoral areas, residents, power supply in the development of medium and small cities or commercial district.

E) High reliability and power quality-In unabated trend of rapid expansion of the large power plants construction, the rapid expansion of power grid brings a great threat to the security and stability of power supply. Distributed power supply uses the control equipment of advanced performance. Open and stop convenient, simple operation, flexible load regulation, and it can greatly improve the reliability of power supply with large power grid distribution, make up the shortage of its security and stability. When it appears the collapse of power grid and unexpected disaster harm (earthquakes, snowstorms, man-made destruction, and war) it can maintain the power supply of important users.

The internal of distributed power supply usually install a local voltage regulation and reactive power compensation, thus ensuring the quality of electric energy. In addition, the investment of distributed power supply relatively compared with large power grids and large power plants is very small, the risk is also smaller, and the construction period is short, is conducive to a short period of time to solve the problem of power shortage.

IV. PROTECTION ISSUES

- Modification in fault current level
- Device discrimination
- Reduction in reach of Impedance relays
- Reverse Power flow
- Sympathetic Tripping
- Sympathetic Tripping

Single phase connection

- Selectivity

V. ISLANDING

Islanding is the situation in which a distribution system becomes electrically isolated from the remainder of the power system, yet continues to be energized by DG connected to it. As shown in the figure1. Traditionally, a distribution system doesn't have any active power generating source in it and it doesn't get power in case of a fault in transmission line upstream but with DG, this presumption is no longer valid. Current practice is that almost all utilities require DG to be disconnected from the grid as soon as possible in case of islanding. IEEE 929-1988 standard requires the disconnection of DG once it is islanded .Islanding can be intentional or Non intentional. During maintenance service on the utility grid, the shutdown of the utility grid may cause islanding of generators. As the loss of the grid is voluntary the islanding is known. Non-intentional islanding, caused by accidental shut down of the grid is of more interest. As there are various issues with unintentional islanding. IEEE 1547-2003 standard stipulates a maximum delay of 2 seconds for detection of an unintentional island and all DGs ceasing to energize the distribution system.

ISSUES WITH ISLANDING

Although there are some benefits of islanding operation there are some drawbacks as well. Some of them are as follows:

- Line worker safety can be threatened by DG sources feeding a system after primary sources have been opened and tagged out.

age and frequency may not be maintained within a standard permissible level. Islanded system may be inadequately grounded by the DG interconnection.

large mechanical torques and currents are created that can damage the generators or prime movers.

equipment. Out of phase reclosing, if occurs at a voltage peak, will generate a very severe capacitive switching transient and in a lightly damped system, the crest over-voltage can approach three times rated voltage.

consequence of voltage& frequency drifts. Due to these reasons, it is very important to detect the islanding quickly and accurately.

VI. MODE OF OPERATION OF MICROGRID CONVRETERS

Normally, converters are used to connect DG systems in parallel with the grid or other sources, but it may be useful for the converters to continue functioning in stand-alone mode, when the other sources become unavailable to supply critical loads. Converters connected to batteries or other storage devices will also need to be bidirectional to charge and discharge these devices.

A) Grid Connection Mode-In this mode of operation, the converter connects the power source in parallel with other sources to supply local loads and possibly feed power into the main grid. Parallel connection of embedded generators is governed by national standards. The standards require that the embedded generator should not regulate or oppose the voltage at the common point of coupling, and that the current fed into the grid should be of high quality with upper limits on current total harmonic distortion THD levels. There is also a limit on the maximum DC component of the current injected into the grid. The power injected into the grid can be controlled by either direct control of the current fed into the grid, or by controlling the power angle. In the latter case, the voltage is controlled to be sinusoidal. Using power angle control however, without directly controlling the output current, may not be effective at reducing the output current THD when the grid voltage is highly distorted, but this will be an issue in the case of electric machine generators, which effectively use power angle control. This raises the question of whether it is reasonable to specify current THD limits, regardless of the quality of the utility voltage.

B) Stand-Alone Mode-It may be desirable for the converter to continue to supply a critical local load when the main grid is disconnected, e.g. by the anti-islanding protection system. In this stand-alone mode the converter needs to maintain constant voltage and frequency regardless of load imbalance or the quality of the current, which can be highly distorted if the load is nonlinear.

C) Battery Charging Mode-In a micro grid, due to the large time constants of some micro sources, storage batteries should be present to handle disturbances and fast load changes. In other words, energy storage is needed to accommodate the variations of available power generation and demand. The power electronic converter could be used as a battery charger thus improving the reliability of the micro grid.

VII. INDIAN RENEWABLE ENERGY SCENARIO AND STATUS OF MICROGRIDS IN INDIA

In the past several years India has seen significant growth in renewable energy generation. Fig. 2 shows installation of various energy resources as in the year 2009 and projected installed capacity in the year 2032. The growth in this renewable energy installation is a combined effect of regional energy development agencies, ministry of new and renewable energy (MNRE), and private sector participation. Supportive government policies are also driving renewable energy installation. The term Smart Micro grid reflects a new way of thinking about designing and building smart grids. Smart micro grids are at the end-user side and have faster implementation. Smart micro grids are to create a perfect power system with smart technology, redundancy, distributed generation and storage, cogeneration or combined heat and power, and consumer control. This is to work together with the bulk power grid or system as an integrated whole to provide its consumers with maximum economic and environmental benefits, reliability and efficiency. The smart micro grid makes smart decisions about what clean energy source to run at what times, links to smart appliances, and regulates energy demand. It can optimize all of the above for cost reductions, energy savings and $CO2$ emission reductions. The integration of multi micro grids at the distribution level will complement the goals of smart grids.

VIII. CONCLUSION

The human production and life are increasingly troubled by the current energy crisis shadows, in order to solve this problem; people begin to pay attention to the new energy, distributed power supply. Distributed generation play a more and more important role, as an important supplement to the traditional forms of power generation, power industry at present. This paper, as a basis research of distributed generation, proceed mainly from the impact of distributed generation on power grid,

detailed fine analysis of the influence of all kinds of distributed generation on power network adverse, including on power system stability, power quality, power supply reliability effect *etc*. In order to avoid these adverse effects, we combining the distributed grid technology and smart micro grid, put distributed generation as a branch of the micro grid that can be ideal to connect grid and can avoid most of the problems mentioned above. The paper provides a reference as the issues in DG and protection issues.

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