

DC Micro Grid and Control System

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Abstract— Generally, the power system are mainly affected by the continuous changes in operational requirement and increasing of distribution energy systems due to because of this causes the effect of deregulation .this paper proposes a new concept that is power –control strategies or schemes for a micro grid generation system for better transferring of power . So that these micro grid are obtained with the general renewable energy sources and this concept provides the maximum utilization of power at environmental free conditions with low losses, then the system efficiency is also improved.

Keywords: Grid control, solar power generation

I. INTRODUCTION

Over the past few years growth in the use of nonlinear loads has caused many power quality problems like high current harmonics low power factor and excessive neutral current nonlinear loads appears to be current source injecting harmonic currents into supply network through utility point of common coupling (PCC).this results in distorted voltage drop across these source impedance ,which occurs voltage distortion to the PCC we known that by reference[1].and about distribution generation and discuss about negative and positive impacts by[2]. History of micro grid by [3].then we know current situations in India and how micro grid will help to solve the problems by [4]. Operation of micro grid controlling techniques and features and benefits of micro grid by [5],[6]. In future how micro grid takes places by[7].

II. ABOUT DISTRIBUTION GENERATION:

Distribution generation refers to a variety of technologies that generate electricity at or near where it will be used, such as solar panels and combined heat and power. Distributed generation may serve a single structure, such as a home or business or it may be part of a microgrid (A smaller grid that is also tied into the larger electricity delivery system), such as at major industrial facility or a large college campus.

When connected to the electric utility’s lower voltage distribution lines, distribution generation can help support delivery of clean, reliable power to additional customers and reduce electricity losses along transmission and distribution lines.

- In purpose of homes and colleges we or generate power in this methods
 - (Residential purpose)
 - Solar photovoltaic panels
 - Small wind turbines
 - Natural –gas fired fuel cell
 - Emergency backup generator, usually fuelled by gasoline or diesel fuel.

A. Positive impacts on distributed generation:

- Existing cost effective distributed generation technologies can be used to generate electricity at homes and businesses using renewable energy resources such as solar and wind.
- Distributed generation can harness energy that might otherwise be wasted.
- By using local energy sources, distributed generation reduces or eliminates the line losses.
- Negative impacts on distributed generation:
- Distributed generation system require a “footprint” [they up space]and because they are located closer to the end user, some distributed generation systems .might be unpleasant to the eye or cause land –use concerns.
- Distribution generation technologies that involve combustion particularly burning fossil fuel.
- Some distribution generation technologies such as waste incineration biomass Combustion, and combined heat and power may require water for steam generation or cooling.
- Distributed energy technologies may cause some negative environmental Issues at the end of their useful life when they are replaced or removed.

III. LITERATURE SUMMARY

A. Microgrid:

What is microgrid?

Micro grid is a small –scale power supply network .that designed to power for designed to provide power for a small community like root tops. It enables local like sv sets. It connected to both the local generating units and the utility grid thus preventing power outages.

B. History of Microgrid:

The historical back ground of dc micro grid we shall go to the days of NICHOLAS TESLA where actually he proposed the ac system are those debt will taken care off but that time power electronics are not available for this dc micro grid put a back side dc micro grid comes in a full present place.

C. History of Micro grids

YEAR	DESCRIPTION
2001	R.H Lasseter of the university of Wisconsin – Madison proposed the concept of “microgrid” and later consortium for electric reliability technology solutions (CERTS) and European commission project micro-gird Also gave their definitions of a microgrid.
2002	The national technical university of Athens(NTUA) built a small laboratory microgird project known as the NTUA power system laboratory facility for tests on the

	control of DER and load with multiagent technology
2003	The university of Wisconsin established a small laboratory a small microgrid (NREL Laboratory Microgrid) with a capacity of 80KVA, for tests on the controls of various types of DRs in different operation modes.

D. Rooftop Solar and Battery Storage Costs an Industry: Cells Costs<<System Costs

	2019 Chevy bolt 60kwh	2018 Battery system 10kwh	Rooftop solar 6kw
Complete system	\$36,000	\$12,000	\$20,000
After incentives	\$27,000	\$8,190	\$14,000
Battery subsystem	\$16,000	\$5,500	NA
Cells/panel only	\$12,000	\$2,000	\$3,600
Cells/panel only	33%	17%	18%

Cells \$200/KWH solar panel \$0.60/watt

IV. CURRENT SITUATIONS:

- Now a days, the world’s power sector facing challenges due to increasing loads environmental issues, low energy efficiency and user’s high power quality needs.
- Micro grids can utilize and control distribution generation in an effective flexible and smart manner, and hence, can best address these problems. The recent studies on the solar systems are presented [8-14].

A. Micro Grid Development in Different Countries:

- The concept of micro grid is originated in us.
- The architecture proposed by CERTS consists of power electronic technologies- based micro grids with capacity of 500kw and loads that integrates power electronic technologies based control schemes.
- In 2003 the goal for grid modernization is set in us to widely integrate IT and communication technologies into power systems to achieve grid smartness.
- Multiple micro grid generation projects are implemented in Japan.
- Japanese scholars put forward the concept of flexible reliability and intelligent electrical delivery system (FRIENDS).
- This FRIENDS excepted to add flexible ac transmission systems (FACTS) to the distribution network to make full use of their advantages in quick and flexible control, optimize the energy mix of the distribution network and meet varying power quality demands.

V. CONCEPT OF MICRO GRID:

Why micro grid and why micro grid matters “of course the reason is that with the greater enhancement of the distributed generation”.

Now what we can say that micro grid is a scaled down version of the centralized power system. It can generate, distribute and control power in a small community. It is reliable and flexible.

- Micro grids are designed to provide uninterrupted power to the balanced load demand for a customer with the changing power needs.
 - It is more secure the power generated logically and its smaller size make micro grids easier to keep safe both physically and given the right control system for cyber threats.
 - It resilient micro grids do not dependent on the traditional grid and can be used to supply critical loads in case of the grid system is disconnected due to faults.
- That means 2012 in India on catastrophic failure because actually huge amount of power hole India was collapse but if we have small isolated micro grid these can survive and catering the all the critical load so this is its religion and it can save money because you need not have to put long transmission line and its maintenance cost you can get rid of so using sophisticated software to monitor, operate and optimize the power usage based on demand, utility prices, and other factors
- Micro grid can be achieved power balance and optimal energy allocations over a given area or virtual power source or load in the distributed generations
 - It can consist of one or more virtual power plants to meet the demand of a load center which can be Important residential building etc.
 - Compared to traditional transmission and distribution networks a micro grid has a much more flexible structure.
 - A micro grid possesses independent controls, and intentional islanding that take place with minimal service interruption.
 - It can utilize and control DG in an effective, flexible, and smart manner, low cost according to government regulations.

VI. OPERATION OF MICRO GRID:



Fig. 1: micro grid system controller

There is many entities you actually you may not require if you concentrate more on the micro grids and another major aspect or major feature of the micro grid is that can store because of small size it is possible to have proper energy management

and incorporate renewable energy most of the case it will have a solar system or micro hydel or micro wind turbine in a seashore places or the hilly places.

This is solar energy is connected to the battery for night time to store the energy there is micro grid substation we are providing office and residential loads substation is connected to utility .can supply power to substation in utility .utility can supply power to substation in case of emergency on if it is not power supplied from the micro grid generation .it power excess store battery.

Sometimes it's cheaper to disconnect from the grid and run a generator that it is to buy power .but the main reason is resilience and reliability when the power goes out, the micro grid can disconnect from the grid and continue to operate using its own distributed generation for your small local grid, so the with the DG, the micro grid would have no generation and not able to function.

A. Micro Grid Operating Modes:

1) Grid connection mode:

- Utility grid is active.
- Micro grid generation is very small it enable to meet the demand of the load in that time utility grid is connected.
- Static switch is closed.
- All the feeders are being supplied by utility grid.

Ex:-our load demand is 500MW we are generating 200MW in that case we are take power from utility.

2) Island Mode:

- Utility grid is not supplying power.
- Static switch is open.
- Feeder a, b, c are being supplied by micro sources.
- Feeder D (not sensitive) is dead.

VII. DISCUSSIONS & RESULTS

- Micro grid could be the answer to our energy crisis.
Ex: in 50 years back total north India .power black part? The synchronization of grid and suddenly due to power station has be shut down in this case energy crisis happen.
In that case we have micro grid we can supply power to the consumers do not depends on utility.
- Transmission losses gets highly reduced why because by using sensors to minimize losses.
- Micro grid results in substantial savings and cuts emissions without major changes to lifestyles.
- Provide high quality and reliable energy supply to critical loads.

A. Interconnected Micro Grid:

- Practical size of micro grid is limited to a few MVA.
- For larger loads, it is desirable to interconnect many micro grids to form a larger micro grid network called power parks.
- The advantages of this micro grid structure ensures greater stability and controllability for the power parks.

B. Environmental:

- Micro grid encourages the use of the renewable energy sources.
- Large land use impacts are avoided.

- Co2 emissions are reduced.

C. Conventional Grid vs Micro-Grid:

- Efficiency of conventional grid is very low a compared to micro grid.
- Large amount of energy in the form of micro grid (often refer to as micro sources) are small and are located in close proximity to load.

VIII. MICROGRID PROSPECTS

- The smart grid is intended for power systems consisting of generation, transmission, distribution, and consumption.
- It allows for smart interaction between all links by developing and introducing advanced control technologies thereby optimizing electricity producing, transmission, and consumption.
- In the smart development, the distribution network must shift for passive to active which supports the DG for real – time participation of the generation and user side in optimizing the power system operation.
- The microgrid is an effective means for an active distribution network which will help large scale integration of DG and transition from the traditional grid to smart grid
- There allow for mutual support with the microgrid, utilize available resources and equipment, and reliable and quality supply thereby increasing energy efficiency and grid security

A. Advantages Micro Grid:

- A major advantage of a micro is its ability during a utility grid disturbance, to separate and isolate itself form the utility.
- In peak load periods it prevents utility grid failure by reducing the load on the grid.
- Significant environmental benefits made possible by of low or zero emission generators.
- The use of both electricity and heat permitted by the close proximity of the generator to the user, thereby increasing the overall energy efficiency.
- Micro grid can act to mitigate the electricity costs to its user by generating some or all of its electricity needs.

B. Disadvantages:

- Voltage frequency and power quality are three main parameters that must be considered and controlled to acceptable standards whilst the power and energy balance is maintained.
- Electrical energy needs to be stored in battery banks this requiring more space and maintenance.
- Resynchronization with the utility grid is difficult
- Micro grid protection is one of the most important challenges facing the implementation of micro grids.
- Issues such as stand by changes and net metering may pose obstacles for micro grid.
- Interconnection standard needs to be developed to ensure consistency IEEE, a standard proposed by institute of EEE may end up filling the void.

IX. FUTURE MICRO GRID IN SMART GRIDS:

- Today's electrical grid must take the challenges to match the modern digital economy and information age, with higher load demands, uninterrupted power supplies high-quality and high-value services.
- The integration of various intermittent and fluctuant RESs will lead to reliable problems of ancillary services, power quality disturbances brownouts, and blackouts.
- New electricity transmission and distribution network is required for integrating the newly emerging distributed RESs.
 - Smart grid (SG) is a modernized "grid" that uses robust two-way communications, advanced sensors, and distributed computers to improve the efficiency, reliability and safety of power delivery and use.
 - The SG system operator is able to:
 - Control the electrical powers customer level, small-scale DGs, and storage devices through the MGs;
 - Communicate information on operating status and needs and to collect information on prices and grid conditions;
 - Transform the under central control into a collaborative network.

X. FUTURE DIRECTIONS ON MICRO GRID RESEARCH:

- To investigate full-scale development field demonstration experimental performance evaluation of frequency and islanded modes on interaction phenomena between distribution generation and high penetration of distribution generation.
- Transformation of micro grid system today into the intelligent robust energy delivery system in the future by providing significant reliability and security benefits.

A. Micro Grid Solar-Wind Diesel Benefits:

- Direct fuel savings 50% to 70% per year.
- Total system payback time of 3 to 5 years.
- Very high wind penetration.
- Power quality of 50/60 HZ plus/minutes 0.5 HZ
- Systems offered from 100KW UP TO 25MW.

XI. CONCLUSION

Micro grid systems facilitate remote applications and allow access to pollution-free energy. They give impetus to the use of renewable source of energy. Moreover, in the event of a power grid failure, a micro grid is one of the best alternatives. This paper has provided an overview of micro grid systems and elaborated on several aspects of control, mode of operation, distributed energy storage applications with in micro grids and desired targets micro grid research fits very well the ongoing smart grid activities throughout the world, and several challenges need to be overcome before it becomes a reality.

In particular, control with limited communication and computing facilities is a challenging problem favoring the adoption decentralized techniques.

Development of micro grid it can save 50% to 70% of fuel. And it offered 100KW up to 25MW.

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