MICRO GRID: CONCEPT ISSUE AND CHALLENGES.

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ABSTRACT: *This paper Present that one of the major requirement of Micro gird in the increasing load demand. The power supply system to remain stable condition when it experiences a load change and contingency. Addition of micro grid in the present utility grid to maintain load and demand management.. In this paper, the micro grid concept issue and challenges are will be studied. The micro grid architecture and different modes are to be study. The study has been carried out on the advantage application and also some of the issue related to power system protection is presented.*

Key Words: MICRO GRID, Architecture, Challenge and Issue of Protection, Adaptive protection, Support system for micro grid

1. INTRODUCTION

Micro–Grid is a small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary. Most Micro-Grids can be further described by one of two categories: Isolated Micro- Grids, islands, and other remote sites which are not connected to a local utility grid. Island-able Micro-Grids that are fully interconnected and capable of both consuming and supplying grid power, but can also maintain some level of service during a utility outage. A Micro grid is a small energy system capable of balancing captive supply and demand resources to maintain stable service within a defined boundary. It is clearly defined Electrical boundary and it is acts as a single controllable entity with respect to the grid system. It is Connect to the grid and its disconnect from the grid. It is able to operate in both grid-connected or island-mode.

A group of interconnected loads and distributed energy resources (DER) with clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. It can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.

2. MICRO GRID

Introduction

Micro grid means a class of technology with utilize computer based remote control and automation. Smart grid: "Digital up gradation" of distribution grid and also large distance transmission grid. The Smart grid is deliver electricity to the consumers using two way digital technologies.

Role of Smart - Micro grid

Consumer can efficiently manage electricity at their end and more efficient use of grid. Demand supply management. Detect fault in self healing process to improve reliability and quality of power.

Component of smart grid

1) Transmission Automation
2) Distribution Automation
3) Renewable Integration
4) Demand responses / Participation
5) Small appliance / PVEV/Storage
6) Distributed Generation and storage
7) Energy efficiency
8) System operation
9) Smart meter

Key Areas for smart grid Initiative in INDIA

1) Advance metering infrastructure (AMI)
2) Meter data Management
3) GIS
4) Enterprise Management
5) Distributing automation
6) Utility portal
7) Automatic Call center
8) Management

Micro grid architecture

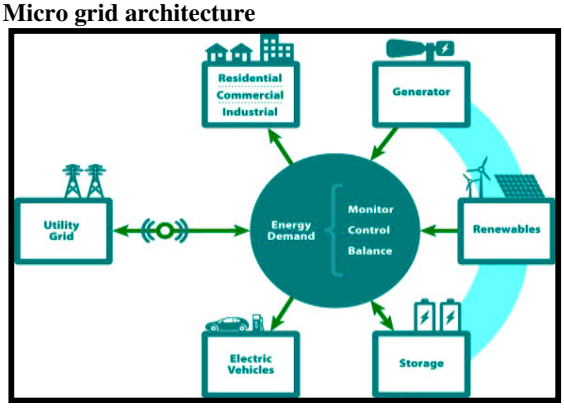

Figure: 1 Micro grid architecture

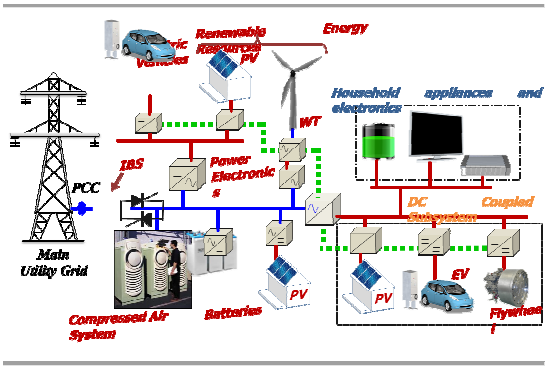

Figure: 2 The Micro grid System

Micro grid operating modes

A micro grid is being a plug and play power unit does have different operational modes.

Grid Connected Mode: The micro grid is connecting to the one of the utility grid via a single switch at the point of common coupling (PCC). At this stage, the DG set of the micro grids are share its load with the grid supply. However, any common load is inside the grid, the grid are determines the voltage amplitude and also frequency of the entire micro grid.

The Grid are in Connected mode encourages the possibility of a bidirectional power flow, where excess generation system by the DG set is returned to the utility grid system.

Transition mode: in the Transition mode the micro grids, it is on sensing a grid outage can disconnect itself from the grid at the point of common coupling (PCC). This sudden when absence of power supply are trigger cascaded tripping inside the micro grid. The Micro Grid unless any proper control action is taken it. Therefore, the advance controllers have designed to handle the transition from the grid and the Grid is connected to island mode. Similarly, the controller action should also ensure a synchronize transition from islanded mode to the grid connected mode.

Islanded mode: In this mode the main micro grid is behaves as an autonomous power system. The micro grids are supplying its own local load demands and common load demands. This is done with the help of proper control actions. So in absence of grid the utility grid are the DG set now determine the frequency of the micro grid and voltage of the micro grid. The Controllers are play a key role in sharing loads among DGs. It has handling DG trips and non-linearity of loads. Success of this mode may make micro grid are more effective solution to the centralized problem of the conventional grid system.

3. MICRO GRID FEATURES:

a) Autonomy
b) Efficiency
c) Scalability
d) Stability
e) Efficiency
f) Peer-to-Peer Model

To Managing connection to distribute power sources

Effective micro-grid technology are provides for distributed and alternative energy sources to the connect automatically to the micro-grid. This is requires the combination of current and voltages Phasor measurements on the both sides of the connection. The connections are along with provisions to automatically sync sources to the existing micro-grid.

Managing the primary grid connection

All micro-grid are connected to the primary grid can be automatically managed along with alternative energy sources. Primary grid management ranges from a complete disconnect from the grid (requiring appropriate hardware) to sharing of primary grid power within the micro-grid itself.

Managing loads within buildings

Load management within buildings has traditionally been handled by building automation systems. Most BAS installations are require to hard wiring from sensors to controllers. So we are used Better alternatives, combination of wireless communications are connected to the building communications network or bypass the building Internet connection and connect directly to the Internet using cellular data packet communications.

Optimize sources

The Sources can be optimized to use the least costly alternatives. An obvious method to minimize energy cost is to use solar whenever available. The optimization process uses an algorithm that reads building energy, from across the micro-grid, while understanding which energy sources are available and at what internal cost. Choosing different energy sources by fuel also provides a method of reducing overall energy costs.

4. MERITS DEMERITS AND APPLICATION

Merits

- Helpful during failure.
- During peak loads.
- Environmental Benefits.
- Efficiency.
- Electricity to all

Demerits

- Balance of V, F, P.
- Storage.
- Resynchronization.
- Net metering.
- Protection

Micro grid Applications:

- Communities/Neighborhoods
- Corporate/Academic Campuses
- Buildings
- Military base camps
- Naval Systems

5. MICRO GRID CHALLENGES & ISSUES

Micro Grid Challenges

A power distribution network are comprising multiple electric loads and distributed energy resources, characterized by all of the following. The ability to operate independently or in conjunction with a micro grid. One or more points of common coupling (PCC's) to the micro grid. The ability to operate all distributed energy resources (DER), including load and energy storage components, in a controlled and coordinated fashion, either while connected to the micro grid or operating independently. The ability to interact with the micro grid in real time, and thereby optimize system performance and operational savings.

Issues with Micro Grid

- Power quality,
- Energy management
- Stability
- Power flow control system
- Protection
- system and integration of various distributed generators

Effect of Fault on Micro Grid Protection

- Loss of sensitivity
- Over current, earth leakage
- Disconnection of generators
- Islanding
- Reducing reach of over current relays
- Single phase connections and loss of stability
- Problems like bidirectional power flow and change in voltage profile

Key Protection Issues

- Reduction in reach of impedance relays
- Reverse power flow
- Sympathetic tripping
- Islanding
- Single phase connection
- Selectivity are

Protection Issue:

A – Modification in fault current level
B – Device discrimination
C – Reduction in reach of Impedance relays
D – Reduction in reach of Impedance relays
E – Islanding
F – Single phase connection
G – Selectivity

Modification in fault current level

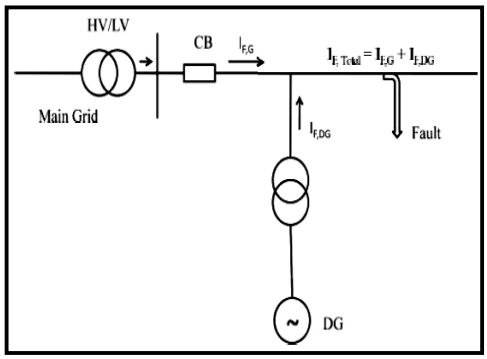

Figure: 3 Modification in fault current level

6. POSSIBLE SOLUTIONS FOR PROTECTION ISSUES

There are various solutions available to overcome protection challenges in the micro grid network. There is reverse power flow or bidirectional power flow, the main relays of feeders which are fed from the substation can be interlocked. The use of directional over current relays can also solve this problem. The other solution is main feeder relay adjustment in terms of time settings. Feeder without DG can have faster relay settings as compared to feeder with DG. Protection of inverter interfaced DG units. Conventional protection systems cannot give reliable protection for inverter interfaced units, because there is limited fault current.

The solution can be achieved by using

Inverters which are high fault current capability that up rating the inverter. To Use faster communication system between Inverter and protective relays. Introduction of energy storage devices that are capable of supplying large current incase of faults.

Differential protection scheme

The conventional differential protection cannot give the reliable protection. The protection scheme for micro grid with Inverter interfaced DG units cannot differentiate between fault current and an overload current, which results in nuisance tripping when system is overloaded. In an islanded micro grid to ensure selectivity, it is important that different distributed generators should effectively communicate with each other. Use of evolving distribution system version of pilot wire line differential scheme is required for protection.

Adaptive protection for micro grid

Adaptive protection scheme solves the problem both in grid connected as well as islanded mode Automatic readjustment of relay settings as per micro grid states. Online system that modifies preferred protective response to change in system conditions. Numerical directional over current relays are used. Effective communication system is required. Individual relays can communicate and exchange information with a central computer or between different individual relays. Main components of centralized adaptive protection system are micro grid central controller and Communication system.

Inverter Controller design

Protection scheme for islanded micro grid is dependent on type of inverter controller, controller can actively limit the available fault current from inverter interfaced distributed generator units.

Business models that will enable Micro-grids

Four models of micro-grid ownership and operation are available in literature:

1. A distribution company micro-grid
2. A single user micro-grid
3. A hybrid micro-grid
4. A multi –user micro-grid

Overview of measurement and control technologies important to micro grids

Supervisory Control and Data Acquisition (SCADA) these systems is provide communication and control of and to distribution automation technology such as reclose. Energy Management Systems (EMS) are Control for Utility Distribution Networks- A micro grid, could relieve distribution system congestion. In Advanced Metering Infrastructure (AMI) provides extensive meter data, including historic usage, load profiles, voltage variations and outages. Unlike existing grids where electricity are generally flows one-way from generators to consumers, [the smart grid] will result in flows of electricity that vary in magnitude and direction continuously. It will be important to design simulation systems that can accurately represent both the grid and the reaction of consumers, in order to predict the emergent properties of the system under a range of different conditions and worst-case scenarios.

The smart grid must be able to make efficient use of intermittent renewable energy sources.

7. CONCLUSIONS

Micro grid is a broad definition of a small Power system. Benefits include reliability, efficiency, renewable. There are Challenges like Control, Communications and Utility interface at PCC. In this paper, the importance of the micro grid is explained. Also present system cannot sustain all load demand so we have to move on the micro grid concept. It was found that the micro grid concept applicable to village, city, institute and industrial level. So we can say that by using the latest technology we can use the present grid as smart grid.

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