Literature Review :

Theortical Background

Due to the environmental and economical conditions and the need to provide a clean environment and decrease the carbon emissions in the atmosphere and due to decrement in the fossil fuels,recent technological developments in microgeneration is microgrid is the future of efficient and fast restoration of power system .

**Microgrid**

The term microgrid dates back to 1882 when Edison installed 50 DC microgrid before the operation of the utility grid .Withe the utilization of utility grid and benefiting from economic and increasing transmission process leading to fade away of microgrids.Certainly in the past years with advancement in technologies of power electronics and DER and more engagement with the electricity consumer the microgrid concept started seeing the light again.

As we mentioned earlier that microgrid is a small-scale power supply network for small community ,it allow the penetration of distributed generation into system.One of its major advantage is that its ability to work alone during utility grid disturbance or outage;in means that microgrid can operate in two modes

i)ON-grid

ii)OFF-grid(Islanded)

ON-grid mode is when the microgrid is connected to the main utility grid and work in synchronization with it, this mode enables bidirectional powerflow and if any disturbance happens to the main grid the microgrid will switch to off-grid mode or whats known as standalone grid (islanded) it acts as main provider to the specified geographical area working autonomously with high quality service by acting as local voltage and frequency regulator [1](An overview on microgrid control)

Microgrid components include load,DERs controller,smart switches,protective devices.Microgrid load are usually known to be of two categories critical and non-critical (fixed and flexible);critical load (Fixed )must be satisfied at all conditions and isn’t altered whilst the non-critical load (flexible) can differ and be adjusted based on the economic incentives or the status of the grid (islanded requirements).

DERs consist of distributed generation units(DG) and Energy Storage System (ESS) which can be installed on the utility or consumer premises.The distributed generation units are eith dispatchable or nondispatchable ;dispatchable units can be controlled by master controller and are subjected to technical constraints depending on the unit type.Nondispatchable cannot be controlled by the microgrid controller as its input is unpredictable and uncontrolled such units are like Solar and wind mainly renewable sources .The intermittency shows that generation is not always available ,the volatility reveal that the generation tends to be fluctuating in different time scales .Those stated characteristic effect our nondispatchable units negatively and usually increase the forcast error a good solution is always to reinforce those units with energy storage system (ESS).

Control hierarchy in microgrids

To be able to understand how the microgrid is controlled and how it can operate in the two modes on-grid and islanded with regards to what the power system control architecture might be there are two distinctive approaches to be clarified: centralized and decentralized.

A centralized control that is characterized by having one main central controller responsible for gathering all the required data for decision making from the various DERs by peforming the required calculations and conclude the control actions for each unit at this single point.

In another hand we have the decentralized control in which we have a local controller for each DERs unit that only receives local information and is neither fully aware of system variables or other controller action.

Implementing a centralized control system is merely infeasible due to the extensive and computation needs that are required due to the interconnected power sytems that cover bigger geographical areas ,furthermore using decentralized approach is also not possible due to the different units in the system that need coordination which is not fulfilled by the local variables so a comparise has to be found between the centralized and decentralized approach in means of hierarchy that consist of three levels :i) primary control ii) secondary control iii) tertiary control those levels vary in i) speed of reponse