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Challenges of RES with Integration of Power Grids, Control Strategies, Optimization Techniques of Microgrids: A Review

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Abstract- The Conceptual views on renewable energy sources, the use of unconventional sources and integration, future challenges for "Renewable energy sources (RES)" and strategies for controlling different types of microgrids are specified in this paper. The importance of RES has increased in the electrical system power network due to their periodic nature. Its generation does not coincide with load point when need for Energy Management Systems (EMS) is created. In this lexicon, Energy management (EM) prefaces an includible challenge in operation of distributed renewable sources connected to grid. The challenge in this type of sources is due to factors such as the infrequent sources, the estimations in time of day, the size of the "solar panels", "battery", limits of the charging, discharging speeds of battery. The novelty of this paper is latest scenarios, potential of solar, wind energy in India is specified in a graphical manner and control strategies, optimization techniques of microgrid are discussed in an elaborated way. In this article, the concepts the basics of microgrid, challenges in integration of grid, optimization techniques and the concept of "Distributed Energy Resources (DER)'s" are discussed.

Keywords Renewable energy sources, Microgrids, Integration, Energy management system (EMS), Solar panels, Integration, Distributed Energy Resources (DER).

Nomenclature

RES-Renewable energy sources	LMT-Low, medium tension	AND-Active distribution network
EMS-Energy Management Systems	DN-Distribution networks	WPG-Wind power generation
EM-Energy management	ES-Energy security	AM-Active management
DER-Distributed Energy Resources	PCC-Point of Common Coupling	REN-Renewable energy network
CES-Conventional energy source	DG-Distributed generators	ESS-Energy storage systems
RRES-Reliable renewable energy sources	BESD-Battery Energy storage devices	EO-Energy cooperation (EO)
MG-Microgrid	DCMG-DC microgrid	PE-Power energy
SG-Smart grid	ACMG-AC microgrid	CS-Control strategies
LT-Low Tension	EST-Energy storage technology	DG-Distributed generation
DER-Distributed energy sources	SES-Solar energy system	MSU-Master-slave unit
PV-Photovoltaic arrays	PS-Partial shading	SMS-Stable micro sources
MWT-Micro wind turbines	SM-Solar modules	HICOS-Hybrid interactive communication
FC-Fuel cells	SE-Solar energy	RTO-Real-time optimization
ED-Energy demand	LCES-Large capacity energy storage systems	OPD-Optimal power dispatch
SES-Solar energy sources	CP-Communication protocol	MAS-Multi-agent systems
WE-Wind energy	TLC-Two-layer control	SAS-Single agent system
DPCA-Distributed predictive control algorithm	PSO- Particle swarm optimization	RDER-Renewable distributed energy resources
	POMMP-Probabilistic multipurpose microgrid planning method	VRE-Voltage regulation errors
GO-Global optimization		VSSE-Voltage steady state error
MGSA- Microgrid scheduling algorithm	MMGS-Multi-microgrid system	BVSC-Busbar voltage stabilizing controller
ABC-Artificial bee colony algorithm	EO-Energy optimization	PD-Power demand

1. Introduction

Renewable energy sources fabricate new confrontations in outlining and transacting the electricity grid. [1]. “Renewable energy sources” are cleaner with a lower substantial tremble than the “conventional energy source (CES)”. These sources of energy are wind, solar, biomass, hydroelectric and geothermal energy in nature. In particular, the “variability” and “uncertainty” in the availability of renewable sources must be duly taken into account in the sophisticated choice-making processes necessary to counterbalance supply and load in the energy system. For better integration of renewable energy sources, Battery Energy technology is introduced. This technology is very important to improve efficiency of power plant and also to recuperate the reliability of the supply. To address environmental concerns such as greenhouse gas emissions, the depletion of energy sources and the aging of today's “transmission” and “distribution” infrastructure and the sprouting demand for electricity, it is required to replenish “Reliable renewable energy sources (RRES)”.

1.1. Microgrids

In this section, the main interest is to give brief idea about microgrids and subpart of microgrid is AC, DC, Hybrid microgrid. In order to solve overvoltage problems, voltage drop, overload, protection in the utility of AC networks can be replaced by “Microgrid (MG)” and “Smart grid (SG)”, for future electricity systems that have been proffered. A microgrid (MG) is power grid network which incorporates “Low Tension (LT)”, “Distributed energy sources (DER's)”, “Photovoltaic arrays (PV)”, “Micro wind turbines (MWT)”, “fuel cells (FC)”, Batteries, supercapacitors, flywheel capacitors. The purpose of the microgrid (MG) commenced as explication to match energy demand (ED) by bridging distributed energy sources along with distribution networks like native substations without the expanding expensive centralized utility power networks. Microgrids (MG'S) are interconnected to “low, medium tension (LMT)” “Distribution networks (DN’s)” through an interface power electronic converter, which offers the opportunity to obtain energy from the electrical network and also feeds the electrical network during the generation of surplus energy. In advent of a fault, the MG dissociates from the public grid as quickly as conceivable, restraints its load using distinctive control methods, in the same manner like “droop check”, a “frequency check”. In this specified condition, microgrid works in island mode. The appropriate features of MG progress “energy security (ES)”, “reliability”, “quality” of electric power network, for local customers [2].

Microgrid (MG) planning is plays a vital role for the fruitful operation of integrating renewable energy. A MG is a collection of pertained loads, energy resources distributed within the MG are undoubtedly delineated electrical limits that act as a unique controllable unit with allied to electrical power network. These microgrids are branched into microgrid AC, Microgrid DC, hybrid microgrid. A microgrid can be connected, disconnected from power network to allow it to operate in power network, island mode. The grid connected operation connected to the network defines that the MG is connected to DN in the "Point of Common Coupling (PCC)”, exchanges energy with it. When the load is greater than the DG (Distributed generators) output, the MG absorbs energy from the distribution network; otherwise, the microgrid feeds excess energy into the distribution network. The operation of the island defines that the MG is disconnected from main grid distribution system in PCC after a grid failure or as scheduled and that distributed generators, energy storage systems, loads within the micro grid operate independently.

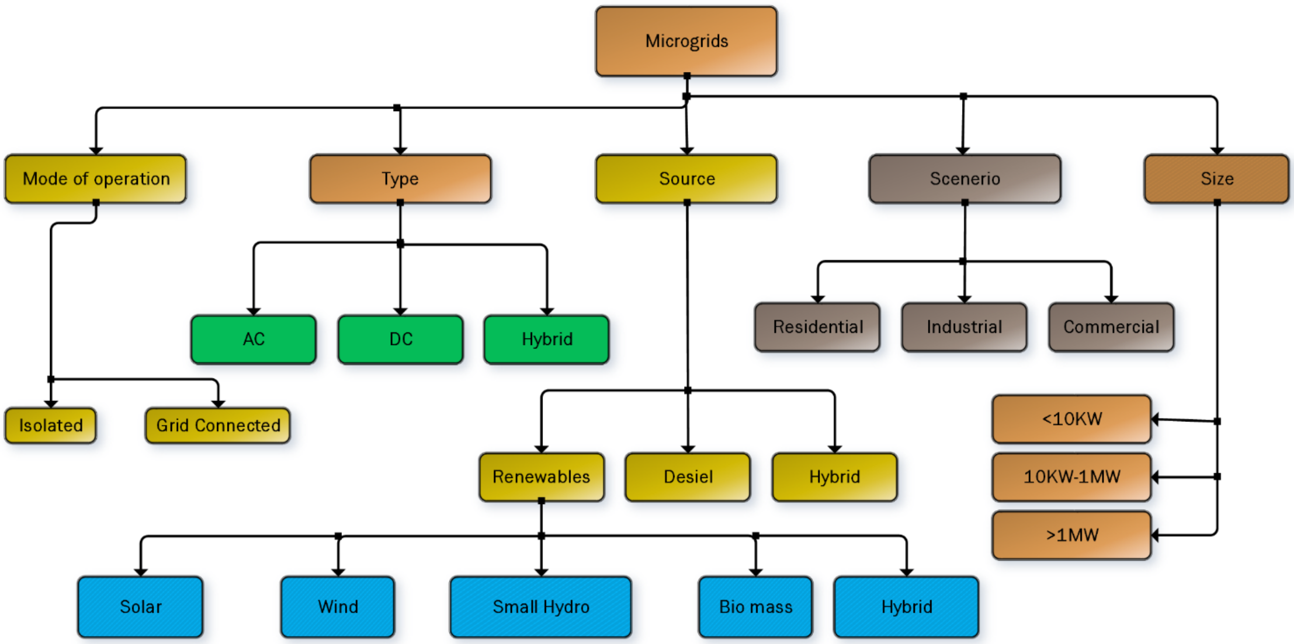

Fig. 1. Classification of Microgrid [3].

1.2. Micrograds

In AC-MG's, the DER's, "Battery Energy storage devices (BESD)" are associated to AC bus via power electronic converter devices. By controlling static switch that connects the MG, the public network, it is possible to transfer the mode between the connected network mode and the island operation. For the control of the ACMG, a stratified control strategy should be used for a better distribution of load, voltage, frequency fluctuations and bidirectional power flows. Especially nonlinear loads require adequate load sharing. The selection of the appropriate control also depends on the prevailing parameters and operating conditions.

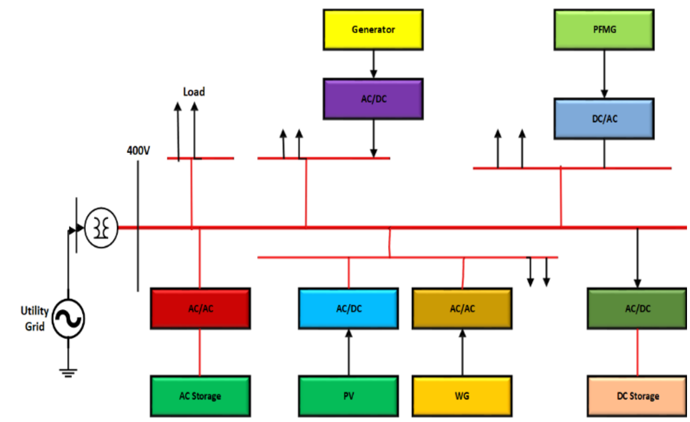

Fig. 2. Structure of AC Microgrid [4]

1.3. DC Microgrid

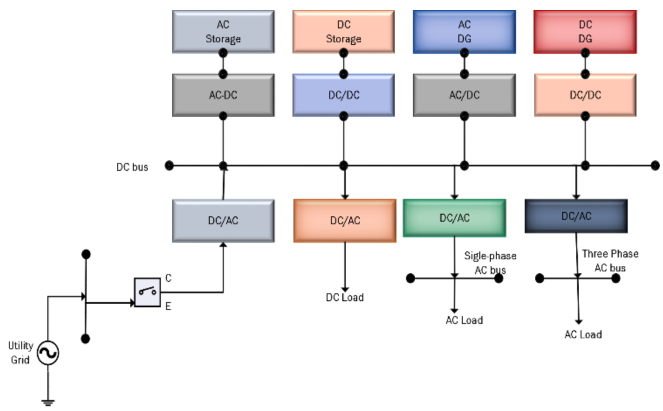

Fig. 3. General block diagram of DC Microgrid [5]

It is evident that DER's, Batteries, and loads are associated with DC bus via electronic power converters. The DC microgrid (DCMG) banded together with the external AC grid (ACMG) through inverter device. The micro-DC network can supply AC power, varying degrees of voltage in DC load can be done via a power electronic conversion device. The ESS are connected to DC bus, to recompensate for fluctuations of "generations" and "distributed" loads. DC Microgrid which has the following advantages.

- The introduction of distributed photovoltaic units is increasing.
- B The reduction of energy dissipation and installation costs resulting from AC / DC conversion is possible by integrating the connection between a commercial network and a DC bus that connects photovoltaic units and accumulators.
- Supply energy to loads through regular distribution lines even during blackout of commercial networks.

When Compared to AC microgrid, DC microgrid there is only level voltage conversion device between each Distributed Generator, there are benefits in limiting circulating current. The hybrid AC / DC microgrid consists of AC, DC bus. It can directly supply AC/DC loads. Precisely, hybrid AC / DC microgrids are considered AC microgrids, since the DC microgrid (DCMG) is certain electrical power supply that connects to AC bus over an electronic power inverter [6].

1.4. Hybrid Microgrid

The "hybrid micro network" has two segments, AC segment is coherence to DC segment by virtue of a bidirectional converter, therefore AC bus is united to distribution network (DN) a transformer. Access to "AC load", "DC load" to MG via appropriate electronic power supplies. The system can be executed in various operating states by controlling bidirectional converter and isolation switch on the "Point of Common Coupling(PCC)",serving as: a) operating state connected to network; b) The AC parts operate in the state connected to grid, while the DC parts work in the island state and the bidirectional converter remains off; c) The AC ,DC parts operate in the state of the island, "PCC" on the isolation switch; d) The AC and DC parts operate independently ,the isolation switch is turned off on PCC while bidirectional converter is turned off at the coinciding time.

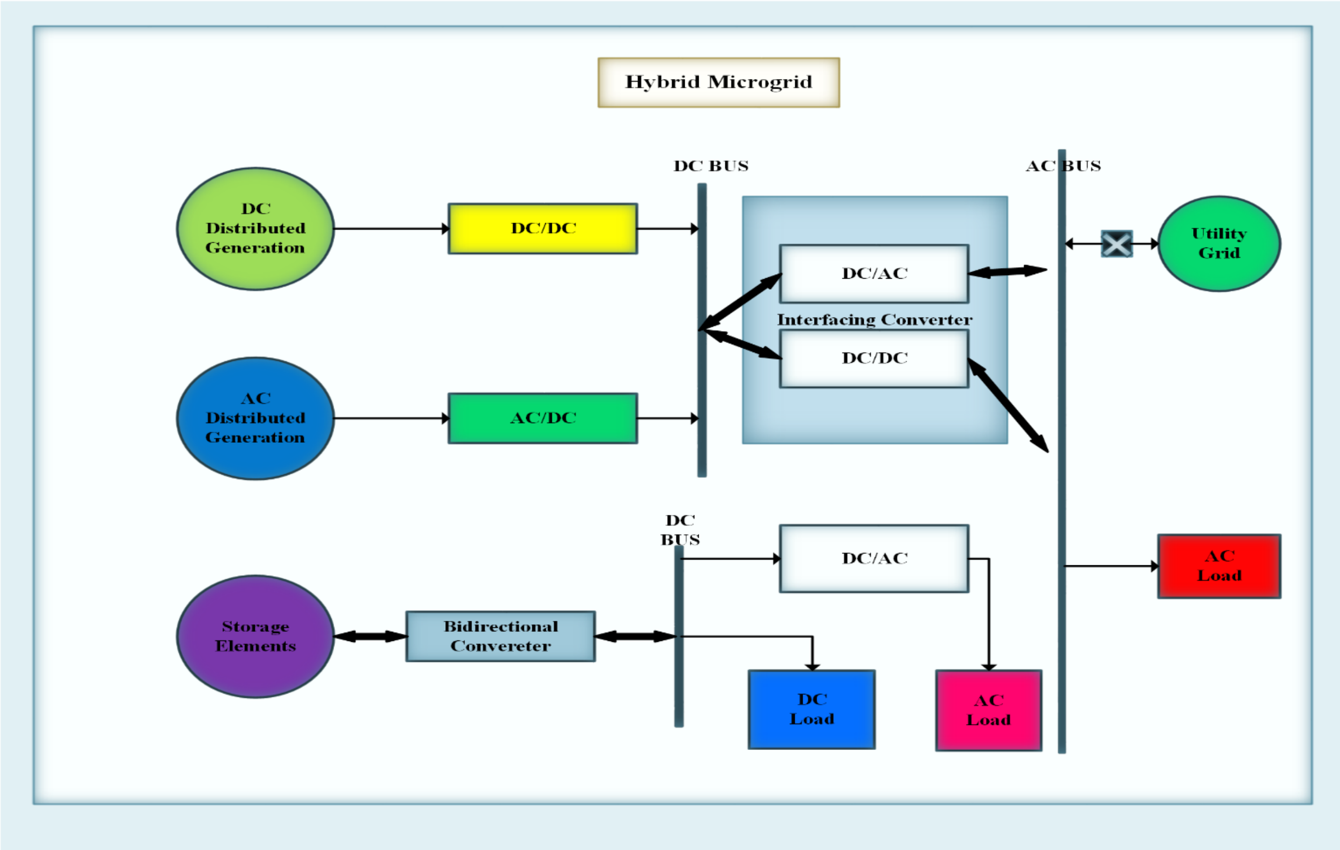

Fig. 4. Structure of Hybrid Microgrid [7]

The microgrid base depends on the distributed generation, it is a powerful complement and an effective support of the public network. "Power matching theory PMT", "Energy storage technology (EST)", inverter avalanched stability, harmonic suppression are the foundations of power management and operation control. With reinforcement of nonlinear energy system, the microgrid [8] will farce imperative role in the application of new power energy systems [7].

2. Potential of solar and wind in India (till 2020)

The following potential of solar and wing in India has taken from Pillai IR, Banerjee R. Renewable energy in India: Status and potential. Energy. 2009 Aug 1;34(8):970-80 [8]. Articulated in terms of bar charts from Figure 5. to Figure 7. by 2022 electrical power targets include achieving 227GW energy from all available renewable sources. India renewable installed power capacity target of 175 GW by 104 2022.

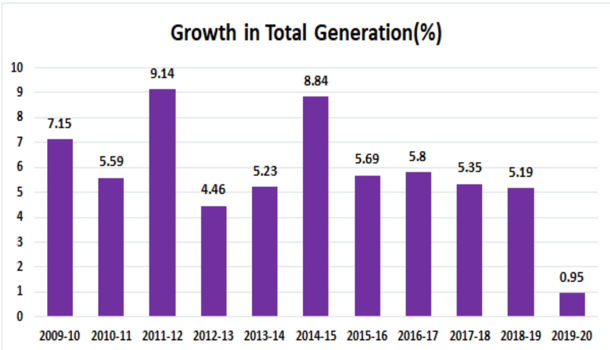

Fig. 5. Growth in total generation in India till May 2020

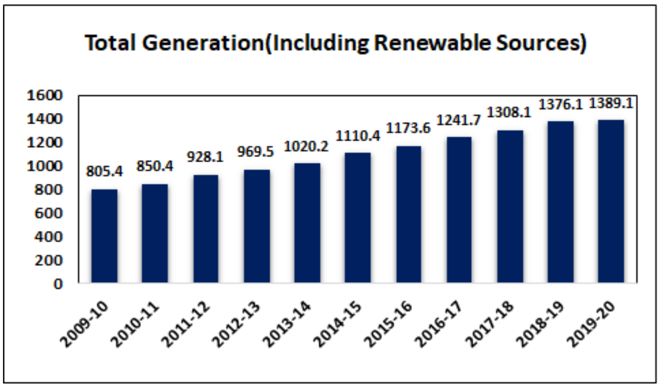

Fig. 6. Total generation in India till May 2020.

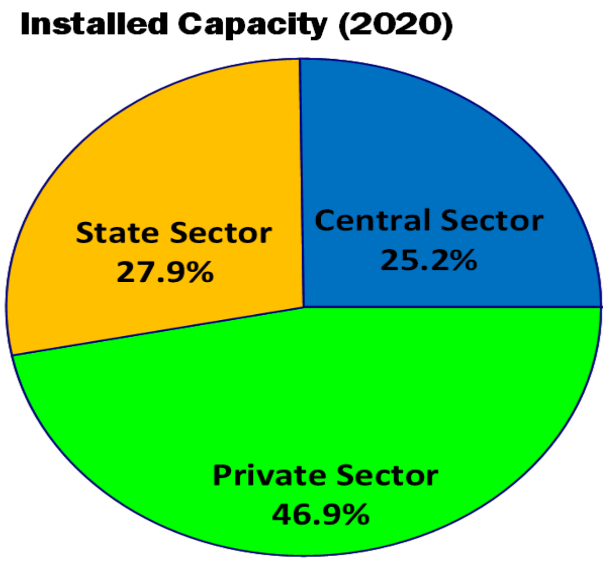

Fig. 7. Total Installed Capacity in India till May 2020.

3. Potential of solar and wind in India (till 2020)

There are many challenges for network operators regarding uncertainty and variability with the integration of “wind energy” and “solar energy”. For this, appropriate measures must be taken to balance the system. Greater flexibility in the structure may be required to satisfy the variability of the offer and the relationship with levels and generation loads. The integration of solar and wind energy will face the challenge of low load levels. The key consideration in choosing the variability and uncertainty of renewable generation is the cost-effectiveness of method and characteristics of existing network system. For profitability, the following solutions are: network infrastructure, operating practices, generation fleet and regulatory structure.[8].

For the “Solar energy system (SES)” the main effects will come from solar irradiance which will automatically influence the “voltage profile”, “frequency response” of the electrical power system. The daylight will have less uncertainty, is quite foreseeable because of velocity of sun is recognized factor. The real anonymous is ubiquity of clouds which inducements the partial shading (PS) obstacle on solar modules (SM) [9]. To decrease the predicaments of uncertainty the location of solar energy forms is much important to trace out irradiance maps and to calculate the transmission lines. The high ingression layers of solar energy (SE) can outcome in more frequency fluctuation at the evident of fault. This complication can be untangled by instating “large capacity energy storage systems (LCES)” in constituents which assimilate huge infiltration of “Solar energy sources (SES)”. The effect of uncertainty can be significantly reduced through the use of electronic power converters, but the problem of further harmonics will arise [10]. The penetration of higher size “solar energy” stimulates a more obstreperous effect on the quality, reliability of electricity [11]. For the above speculation, the coronation of comparably shorter and distributed solar power plants impending to consumers is a legitimate orientation worldwide to reduce the effects of the uncertainty of solar radiation.

The “Wind variations”, “uncertainties” are greater than “solar radiation”. This scale down indistinguishable of energy production from wind energy sources, security of energy system. The immense invasion of wind energy (WE) into the electricity grid will cause many integration problems such as the penetration of solar energy (SE). The main problem with the high diffusion of wind energy are voltage fluctuations [12]. The acceptable nominal fluctuations of the operating voltage “(0.9 pu - 1.1 pu)” at network point are normal operating settings such as rigid voltage and frequency support. The wind turbine failure will increase due to the addition of induction generators that are different from the classic synchronous generators that are unable to supply reactive energy to the network, voltages on the “circuit breakers”, the “transmission lines”, “the buses” increase at time of breakdowns [13]. as single line on ground, double line on the ground, line on line. The most important aspect of “Renewable integration” is the distribution network. The DN can analyze the everyday operation of the “active distribution network (ADN)” with the amalgamation of “wind power generation (WPG)”. The active management (AM) technologies of the active distribution systems are applied in such a way that the components of the power “DN” can be restrained in real time on the basis of coexisting mensuration’s of voltage, current in the network. The prospected frame of reference for the “Distribution network service provider” maximizes the advantages in the short-term programming model. The DNO model addresses battery charge / discharge decisions, the substation transformer load switch and the reactive power compensator challenge as three active management options [14].

The traditional “DN” is made up of uncertain factors which influence the result of voltage optimization and load fluctuations. The integration of renewable energy represented by wind energy, photovoltaic energy not only transforms the attributes of energy flow of “accustomed distribution network”, but also its connection of the electronic energy converter, which accomplishes the voltage peculiarities of the DN, whether stable or transient, has consort about significant changes, and therefore predominating the voltage of “DN” has posed great challenges. Maintaining the voltage level of DN and establishing an appropriate control strategy for the different situations of connection to the renewable energy network (REN) makes voltage in distribution network logically unflappable, optimized. In order to obtain a flexible supply voltage of the control system, to convalesce the functioning grade of the reactive power and to satisfy the demand of master users in the predicaments of the resourcefulness to optimize, control functioning of power generation of distribution and renewable energy networks [15].

The energy deficit is also a one of the major concerns for integration. The energy deficit must be mitigated by extracting conventional energy from main network, even when electricity expenditures offered by main network are high [16]. "Energy storage systems (ESS)" can be implemented together with renewable energy generators to store excess energy and be discharged in the event of an energy deficit or when the electricity expenditures offered by the main network are high [16]. Simply confide purely on "ESS" is not a feasible quick fix due to its limited capabilities, high prolongation costs and losses during loading / unloading [17]. With accomplishments in smart grid (SG) technologies, energy cooperation (EO) between microgrids should be proposed with a contemporary explication to achieve “reliable” and “cost-effective” manipulations of microgrids [18]. The malleability of renewable energies to “VSC-HVDC” network will metamorphose an imperative factor influencing the functioning of the network. There are two problems with the integration of renewable energy islands. The inaugural predicament is how “VSC-HVDC” network implements stable AC voltage to RES without having the support of the AC network. The second problem is how to preserve the power balance of “VSC-HVDC” scheme in case of failure. If receiving end fizzles, the “power energy (PE)” cannot be sent. When sending end aborts, energy will pile up on “VSC-HVDC” network [19].

The undulating attribute of renewable energies is a one of key element that deadlines blimp-scale integration with the electricity grid [20]. To smooth out inconstancies(fluctuations) and gain around the integration of the REG, investments are being developed on the supply side, that is endowing deeper peak units [21], transferring energy between regions [22], and installing energy storage devices. Stages of time for demand response resources (DR) of various types have been proposed by many scholars to smooth out fluctuations of renewable energy (RE). To understand and solve fluctuation problems, it is necessary to introduce a solid optimization and the unpredictability’s in renewable energies and DR resources of various types are described below in anatomy of robust intermissions on multiple time scales. A multi-objective programming model should be created with the aim of securing the under most operating price and the paramount cost of use of renewable energy, taking into detail the integration constraints of renewable energies, the production constraints of DR and the balance of system power. Conferring to the peculiarities of the model, the uncertainty problem turns into a predestination problem using a solid analogue transfiguration and the algorithm must be designed to solve this type of problem. To solve this fluctuation, it is necessary to calculate some constraints such as real power and reactive power. According to the regulations on the integration of renewable energies in [23], when RE is integrated into electricity grid, the inconstancy rate of active energy must not surmount 10% in 1 minute,33% in 10 minutes. In the concluding of this section which is dealing about challenges in grid integration voltage fluctuations, frequency response, fluctuation of load, stability of AC voltage, designing of power electronic converters, balancing of VSC-HVDC system and calculation of optimization of fluctuations in renewable energy sources, designing algorithms for estimations of constraints like active, reactive power are the discussions of renewable integration problems.

3.1. Solar Integration Problems and Wind Integration problems

The total grid integration problems are classified as solar integration, wind integration, the confrontations correlated with solar integration are of voltage stability, frequency stability, power quality[1]. The large-scale systems will face power quality issues like “harmonics”, “voltage fluctuations”, “voltage dips”, “interruptions”, “signalling voltages”, “power frequency variations”. The harmonics problems are coming from power electronic inverters used in converting renewably generated DC voltage into AC. Harmonics are created by certain loads who introduce frequencies that are multiples of 50Hz,60 Hz. Wind energy is current “star” in field of renewable energy.

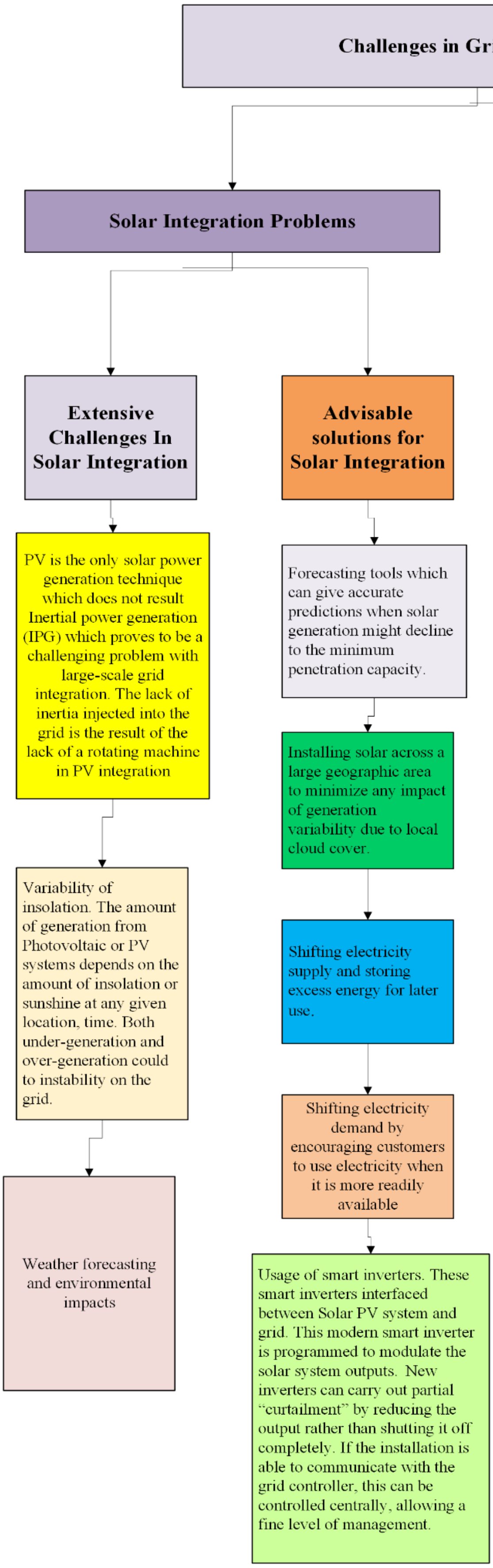

Fig. 8. Challenges in Solar and Wind Integration

4. Research Progress

For fruitful integration of renewable energy sources, controlling of microgrid is much important. In this segment control strategies (CS) and optimizing techniques to ameliorate the performance of microgrid are mentioned. With this knowledge of research progress microgrid can integrate "Distributed generation (DG)", renewable energy sources in an effective manner. By improving microgrid performance we can recuperate power supply "reliability" and "security" in islanded mode operation of grid. Not only yieldable operating mechanism of MG, but also high-trait electricity services are relying on intact, reliable control system, notably control system of inverters [24]. Power electronic inverter control strategy can be clefted into three standards; "constant voltage", "frequency control (V/f control)"; "constant power control (PQ control)"; "droop control". The control reference, control states in different operating approaches cannot be equal amid transients, which can inducements inrush current, transient over/under voltage in the course of operating mode of transition [25]. The control strategy is depending on switching states between master-slave unit (MSU) of inverter, switching co-ordination between physical states of inverter switching states, control modes of switching, proposed impressive timing -coordination benchmarks. If MG is operating in isolated island mode of operation, master unit consistently practices "V/f control strategy" to assure voltage, frequency stability of unified MG, while another slave unit (SU) adopt "PQ control strategy" to insure constant active, reactive power output. The utmost influential principle for culling master unit (MU) is that unit preserves copius capacity to regulates transitory power changes. The array of "large-capacity battery", "diesel generator sets", "gas turbines", "stable micro sources (SMS)" are customarily conscript to MU, which are uncomplicated to control, can emanate reactive power [26].

4.1. Control strategies

An exemplary microgrid (MG)with "Multiple energy generator Microgrid (MGMEG)" consists of integrated renewable energy systems (IRES) that incorporates "solar energy (SE)", "wind energy (WE)", "photovoltaic", "biomass", etc., "fuel cells", "energy tanks", "local loads". The very imperative notability of an "MGMEG" is competence to detach itself from public service system (PSS) during an interruption of the public service network. Electronic power interfaces, generally mains voltage inverters (VSI), play a crucial character in "integration", "intelligent control" of MGMEG [27]. There are three MGMEG "peer-to-peer(P2P) controllers", "two-layer controllers", "multi-agent controllers". The P2P control scheme is for voltage recoveries, reactive power sharing of multiple distributed energy (DR) resources based on AC microgrid inverters (ACMG). For P2P, each DR requires measurement of local voltage and current from the nearest neighbours for control of shared voltage and reactive power through the use of low bandwidth (LB) communication channels. The "communication protocol (CP)" used in P2P to modernizes control inputs not only restores voltage size of the "critical load points (CLP)" to desired value, clinches a meticulous exchange of reactive power for exclusive local intelligent load [28].

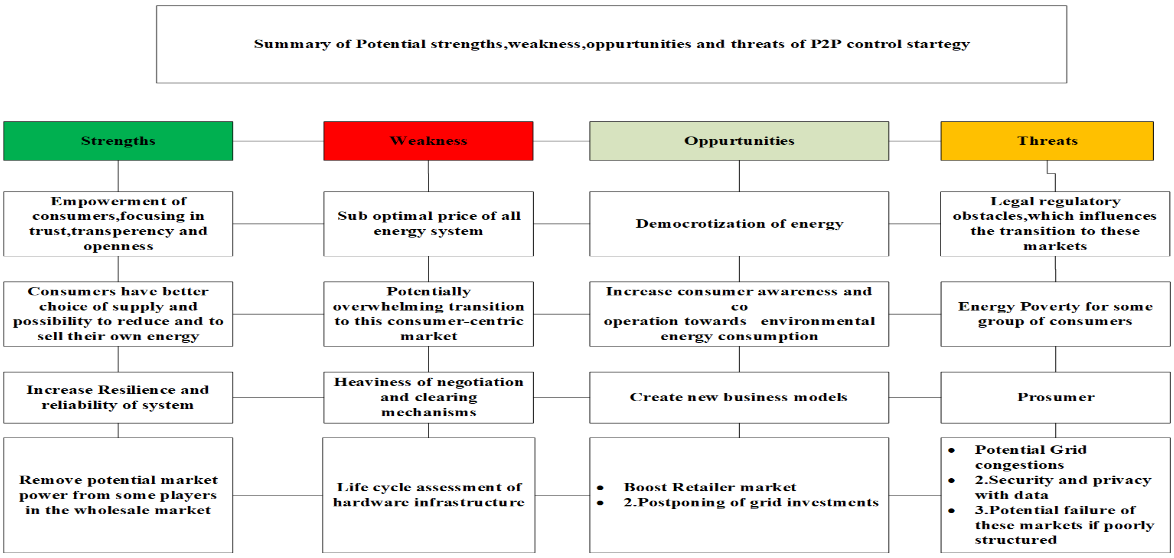

Fig. 9. Summary of Potential Strengths, Weakness, Opportunities and Threats of P2P control strategy

The "two-layer control (TLC)" is proposed for budgetary excretion of "hybrid AC/DC microgrid". It inheres "AC" , "DC" sections akined by one IC [29]. Each section in two-layer control alacrity is available DERs unrestrictedly exchanges the relevant instruction with other section for attaining the "optimal power dispatch (OPD)" of MG. Each category has finalized orientation on its power network, DER scope, cost function but lacks the meticulous knowledge relevant to the other articulation. This mechanism will augment the "Information privacy "and "dwindle communication" burdens.

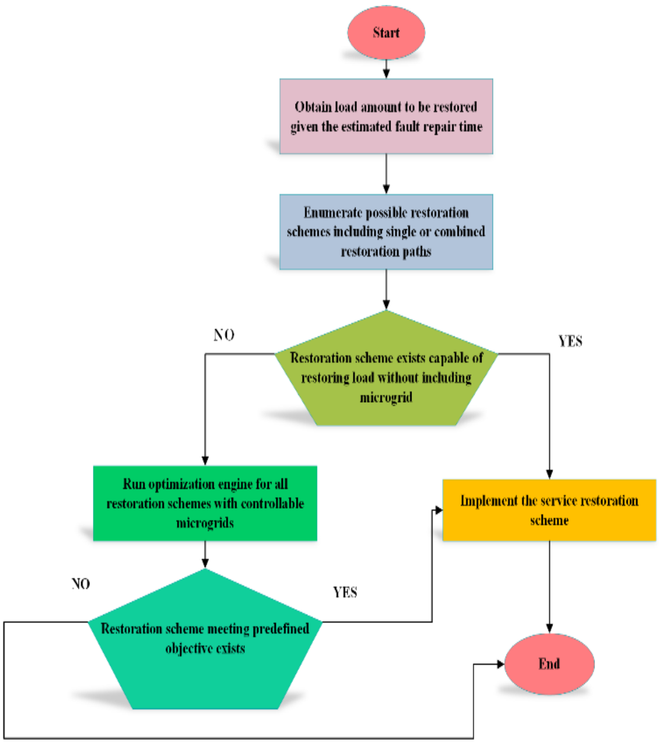

Fig. 10. Two Layer Control Flow chart.

"Multi-agent systems (MAS)" are shaped with "multiple intelligent agent systems (MIAS)" which interacts to elucidate problems that could go farther the effectiveness of a "single agent system (SAS)" [30]. MAS schemes and conceptual planning's have been suggested for energy engineering relevance's. With the growing practices, modelling of distributed energy resources for microgrid (MG) utilizations, MAS is able to manage the range, ramifications of power systems networks.

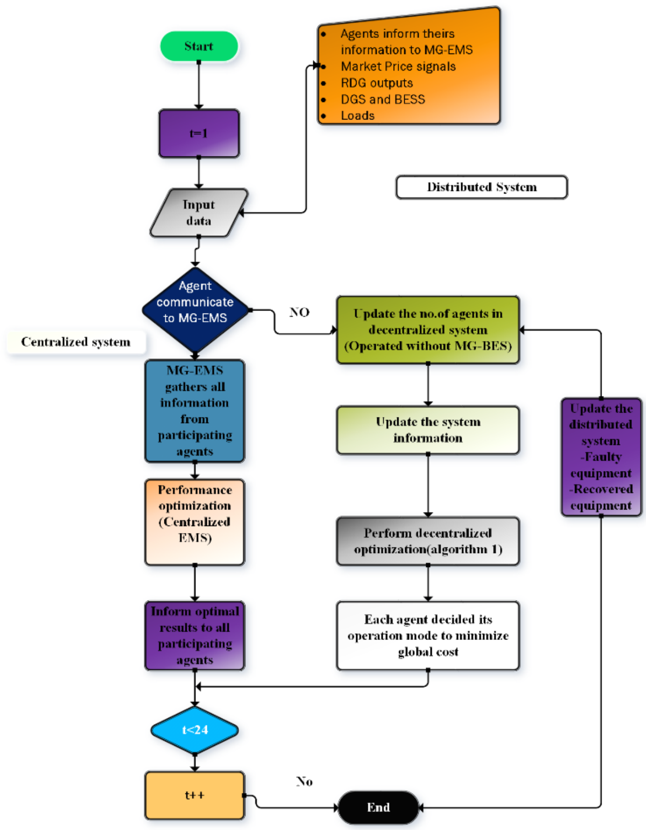

Fig. 11. Multi Agent System (MAS) Flow Chart.

The control strategies of microgrid VSI are voltage, frequency and droop control. This control strategies part deals with different purposed methods to control voltage, frequency.

The "voltage droop control technology" is one of the technologies endorsed to control the exchange of energy between the parallel energy storage (PES) units in the microcredit of the DC island due to its low-price tag in the control, communication system, many necessary Sensors voltage and current in "conventional droop control method". An renovated droop control is proposed to scale down current sensors [31]. To obtain command of voltage drop, the power transmitted by the power converters [48] is reckoned without ascertaining the output current, therefore function of the input and output variables of converter, control variables which are proportional to output power of the converters is ratified in upgraded droop controller.

The phase delay methodology [32], is introduced to generation the fictious quadrature signal in order to contend the "PQ theory" of "three-phase systems". This scheme is characterized by self-reliant control of "Active power (P)", "Reactive power (Q)" owing to "independent PQ" reference signals which can quench appearances of modern MG-tied inverters fed from RES.

The output voltage of bidirectional "AC / DC" interconnection converter [33] connected to AC, DC subnets must have same amplitude, frequency, phase of AC microgrid voltage in case of interconnection ACMG with DCMG. The interconnection of AC / DC microgrid also enhance the stability of the microgrid. Meticulous detection of frequency, phase, amplitude of the AC voltage is the prerequisite for grid-connected synchronization practice. Because of this fact, a synchronous network connection practice is contemplated. The conventions of “bidirectional AC / DC converter” is imported, the complication of the impulse current is calculated in techniques of connection to grid.

DC Microgrids when they interconnected with “Renewable distributed energy resources (RDERs)” will have “voltage regulation errors (VRE)”; “harmonics”; “circulating current, load sharing problem”, “voltage steady state error (VSSE) (ess)”. One of the suggested methods is combining of two controllers specifically P/V droop controller, “Busbar voltage stabilizing controller (BVSC)” [34]. By adopting P/V droop controller a dynamic load sharing amidst the converters [47] with respect to their KV A rating is ingrained. These controllers will cause droop in voltage level of Busbar. In order to eliminate voltage droop because of enlarged power demand (PD) BVSC controller is pre-owned which is intensified with PID controllers. In this section I discussed few methods for control strategies and different types of controllers.

4.2. Optimizing Techniques

This section deals with the basic idea of various methodologies and “optimization” criteria for the optimization of microgrids. The study of the multiple lens “optimization technique” exhibits exceptional achievements by bringing together intelligent “optimization techniques” plus “adaptive techniques” [35]. “Optimization techniques” should justify the investment cost of a Microgrid by allowing the fiscal and decisive use of resources. The operational and control involvement of a Microgrid is cited in [4] listed below.

- Perpetuate the quality of energy and the equity between active, reactive power.
- It must work both independently and connected to the network.
- Energy storage system (ESS) properly planned to provide backup. Operation Economic operation must be ensured through energy planning, the sending of economic loads, optimal energy flow operations. “System security (SS)” must be substantially preserved.
- The temporal discrepancy between generation, load must be assuaged by emphatic forecasting of load, generation.

An “optimization” method to encounter an optimal solution or optimal explications is not always guaranteed. Without deliberating optimization techniques, cost-benefit ratio of MG cannot be vindicated. Optimization intends to pinpoints the best flipside from a collection of specific elucidations that they are most convenient or that have zenithally possible performance with specified limits [4]. Many authors have suggested that AI is one of the promising methods of minimizing MG costs. One of the suggested optimization techniques is the “Particle Swarm Optimization (PSO)” technique. PSO is a solid optimization technique is enforced in changeable MG relevance’s can figure out continuous as well as discrete optimization complications, It is quiet easy to implement, malleable, speedily calculated. PSO is ultimate proceeding for MG optimization problem [36].

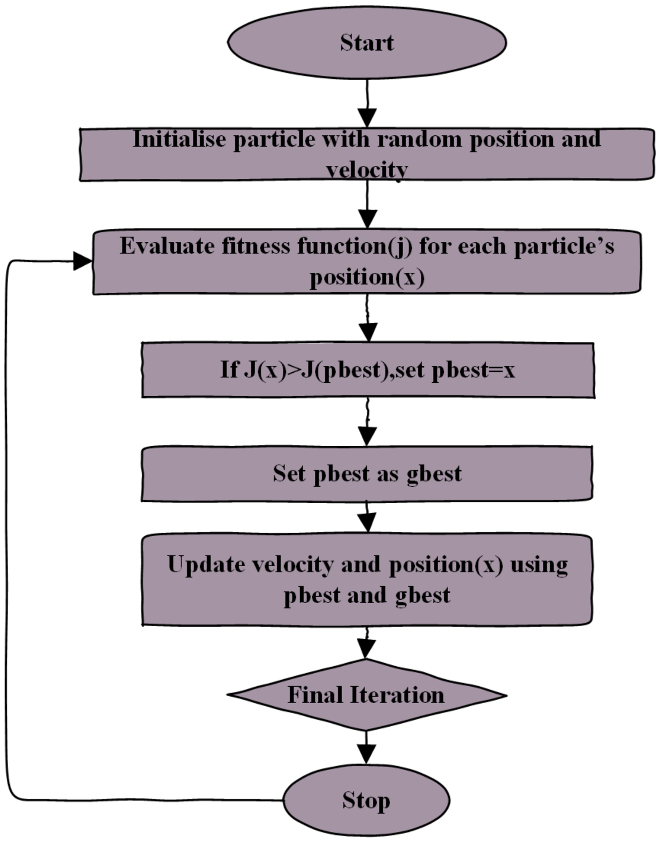

Fig. 12. Flow chart for PSO algorithm [9].

A “probabilistic multipurpose microgrid planning method (POMMP)” which is suggested to perceive optimal positions, capacities of distributed energy resources (DER’s) considering three objective concerns: minimization of power mismatch in island mode; maximize “residual active power” that will be exported to main power network; minimize annual energy losses in “grid-connected mode”. [36].

To deflate the intricacy of assessing the “Optimization contrivances” pre-owned in the “energy management (EM)” of a “multiple microgrid system (MMGS)”, “EOM” method situated on the predictive model is adopted. The scheme of deposition, systemization is endorsed to find a proportionate in-between “power supply”, “user demand”, cost of power is disparaged by harmonizing excess strength in "multi-microgrid system (MMGS)". The energy management mode (EMM), the problem of energy optimization (EO) is established based on characteristics of power flow of the MG. A dual disintegration(putrescence) accession is infringed to break optimization complications are sectionalized in two parts "distributed predictive control algorithm (DPCA)", "global optimization (GO)" are popularized to obtain optimal solution through repetition, coordination [8].

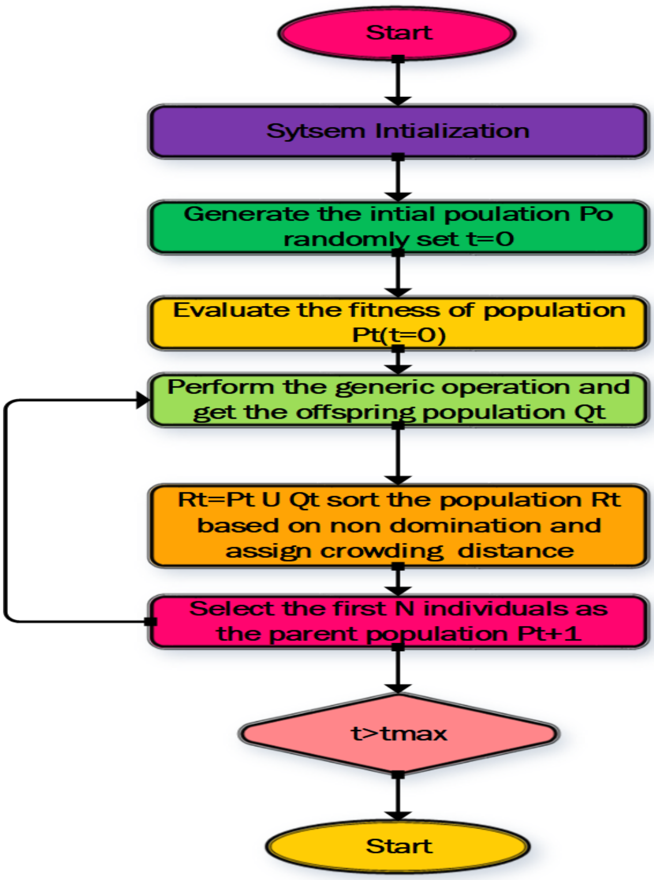

Fig. 13. Flow chart for Multi objective optimization [36].

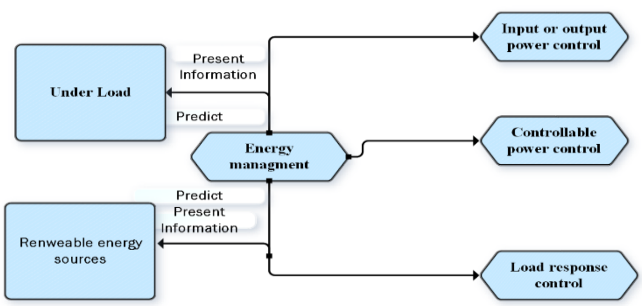

Fig. 14. General block diagram of Energy management optimization [8].

The concept of "perfect sending" (PD) [37] was initially proposed in the PJM interconnection initiative to recuperate real-time pursuance of electricity grids, which invokes to commitment of fabrication yields and the minimum sending solution. taking philosophy of forthcoming conditions, judgements [38]. PD percolates direct pensive optimization across the unified dispatching prospect of interest. Disastrously, PD cannot be thoroughly implemented in real time utilizations because the weather conditions cannot be utterly predicted. Based on the PD algorithm, a combative "microgrid scheduling algorithm (MGSA)", "CHASE", is initially prospected in [39,40]. Adopting "PD algorithm", online verdicts are contrived by monitoring the concealed PD solutions retroactively. Distinct from fanatical accessions, the "CHASE algorithm" does not rely on posterity eruditions while planning attainments has a substantial guarantee depicted in [39–41], the foundations are set down and a unfamiliar direction is suggested for the management of the uncertainties of the functioning of the micro-grid on the theoretical guarantee of performance. Situated on "CHASE", "r-CHASE" , "i-CHASE" are contemplated in[42] to farther actuates the benefits of tantalization and the prognostication of intervals for microgrid planning. The "CHASE algorithm" is devised for "single", "multiple", "homogeneous", "local generator" applications. In this document, we depict a generic planning algorithm inspired by retrospection, CHASE, which integrates and elongates CHASE algorithm by approaching applicability to planning of numerous heterogeneous generators. In the "Perfect Dispatching" method, the microgrid energy is programmed on the subsequent postulations[52].

- The microgrid system works in a self-sufficient way. The external network satisfies the power discrepancy between the programmed power and the net load of the system.
- Renewable energy generators[50], which include photovoltaic solar energy and wind turbines, the distribution generators operate freely and are not available for dispatch.
- The microgrid system works temporarily. shipping codifications are systematically shipped to despicable units at the inception of each time interval and take fallout without lag. The production of local generators, renewable energy, load demand in each time interval must be constant.
- The generation of renewable energy and the demand for electrical load must have specific precision.

A "hybrid optimization algorithm (HOA)" is contingent to model, supervise microgrid system (MG). The authority of the "energy sources (ES)" distributed with MG is a multipurpose obstacle consisting of "wind turbine (WT)", "photovoltaic field (PV)", "fuel cell (FC)", "micro turbine (MT)" and "diesel generator (DG)". The hybrid model is to disparage fuel worth of MG sources such as FC, MT, DG. The framework of the problem takes into account the optimal disposition of MG at a slightest fuel price, operating, sustainment prices, in conjunction with the reduction of emissions. The "hybrid algorithm" is accomplished as an "Artificial bee colony algorithm (ABC)", which is applied in two stages [55]. The first phase of ABC reaches "optimal MG" contour at downplay fuel price for the requested load request. From the characteristics of attenuated fuel cost, operating, subsistence costs, as well as emissions, are reduced by using the flash phase of ABC [43]. With the substantial augmentation of "Distributed generation (DG)", it's crucial stint in "Microgrid group (MGC)" grow into a pragmatic restraint layout to facilitate DG integration [53]. A "hybrid interactive communication (HICOS)" optimization elucidation stationed on ductile assertion is recommended, which is used to resolve the on / off eventualities of microgrids in optimizing [45] MGC energy distribution. HICOS which subsists of stratified architecture: uppermost layer utilizes a control [48] dispensed amidst multiple microgrids, without a radical controller for MGC, subordinate layer makes use of a pivotal controller for individual MG. Established on yielding dissemination links in between microgrids, optimal verbose orientation is exchanged between microgrids, so HICOS would deliberately concurrence towards the optimal mundane explications [37]. Offline, online optimizations are needed to improve MG operations in relation to energy demand, renewable energy resources and the economy of the grid.

"Offline optimization": electrical power network management is generally systemized as offline optimization crunches. This accession is stationed on presumptive accomplishment of climate conditions on predetermined load profile (LP) of MG. This blueprint is applied to assess predication of EMS in real time, considering it persuades intellectual minimum cost of the feasible energy. Online optimization which is called as "real-time optimization (RTO)": "load profile", "weather conditions (WC)", fuel costs transformation over time. "Real-time optimization" [46]is essential to diagnose optimal quick fix inconsiderate of disparity of above parameters. Compliance with online algorithms [49] craves a attainment calculation gizmo to enumerate the predicament at each occasion interval, conspicuously when the time interval is short [54].

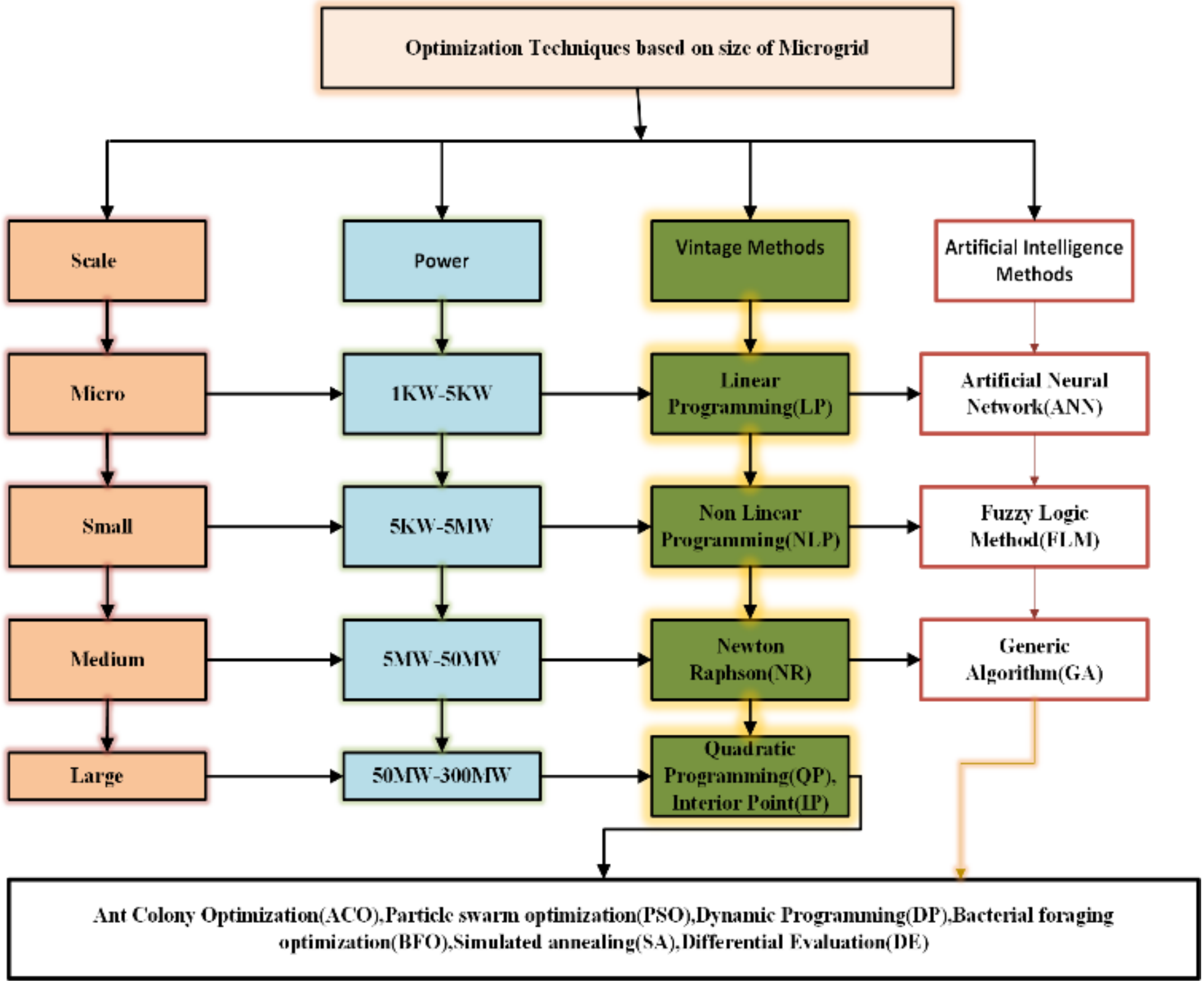

Fig. 15. Optimization techniques depending on capacity of the microgrid [4][47].

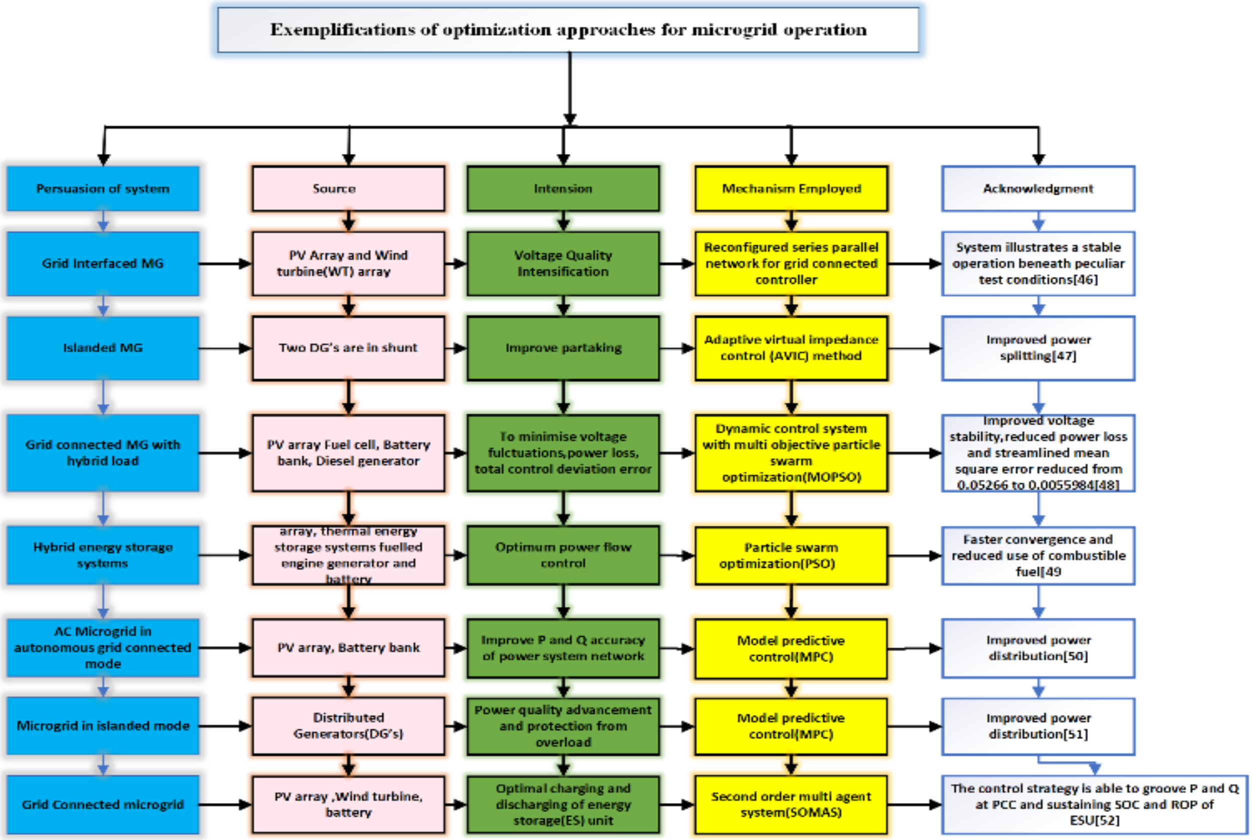

Fig. 16. Exemplifications of optimization approaches for microgrid operation

5. Grid Codes

By applying GC, the developers of PV system can achieve required balance between cost, international standards. GC can increase robustness of power system, level of penetration, generation technology. In this lexicon, the "definition of GC", "technical requirement of GC", "Testing of Primary Frequency requirements (PFR) capabilities", "Generation Requirements" and "Primary Reserve requirements are discussed.

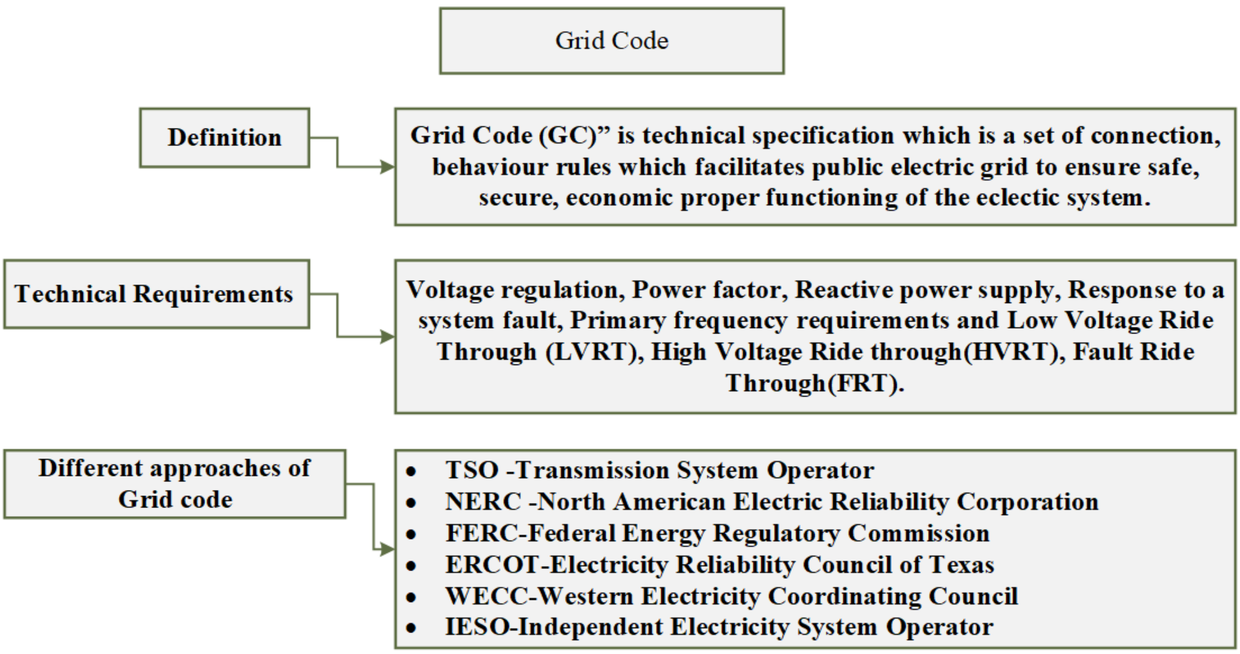

Fig. 17. Importance and approach of Grid Code (GC) [44].

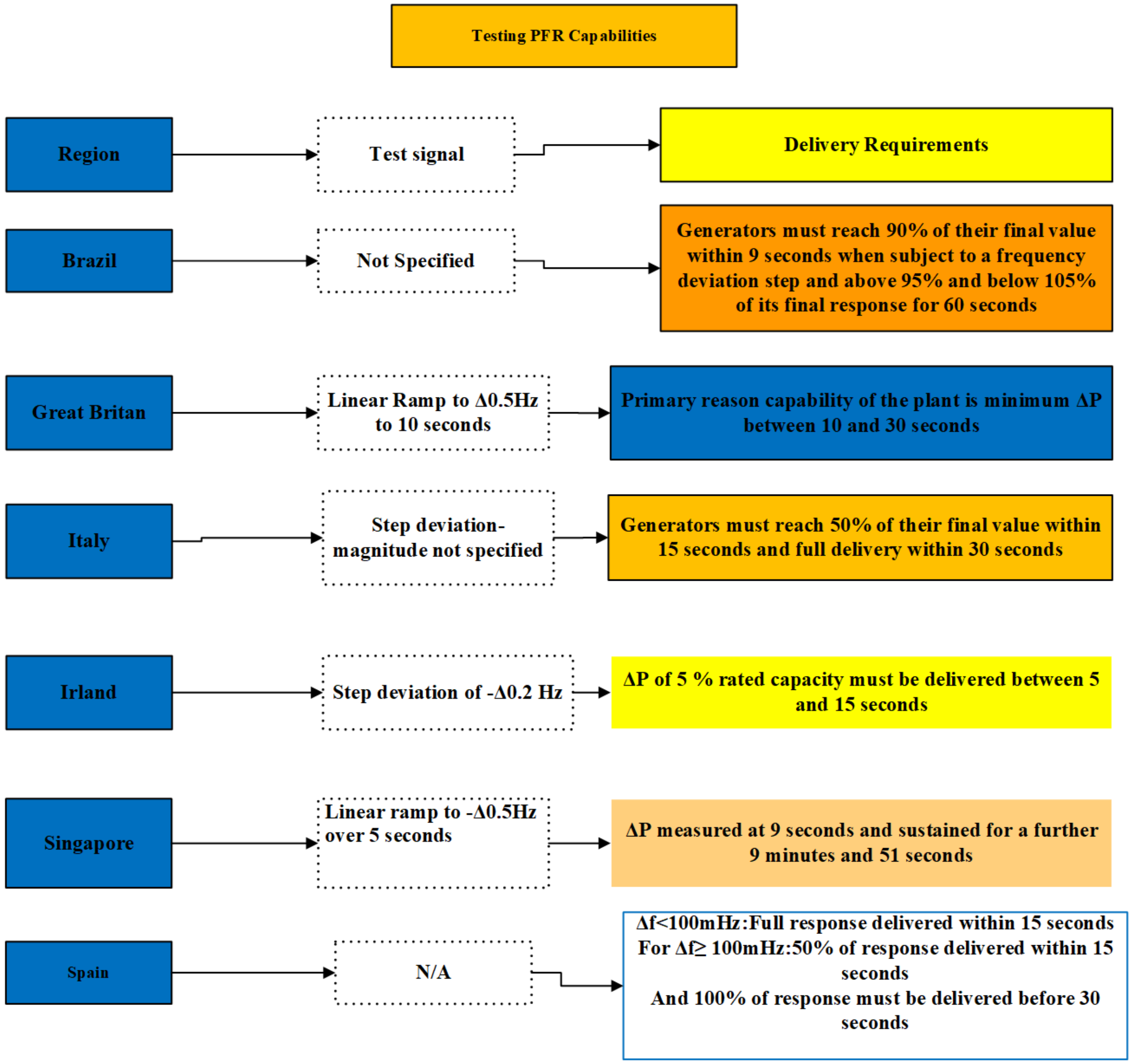

Fig. 18. Testing of Primary Frequency capabilities (PFR) [45].

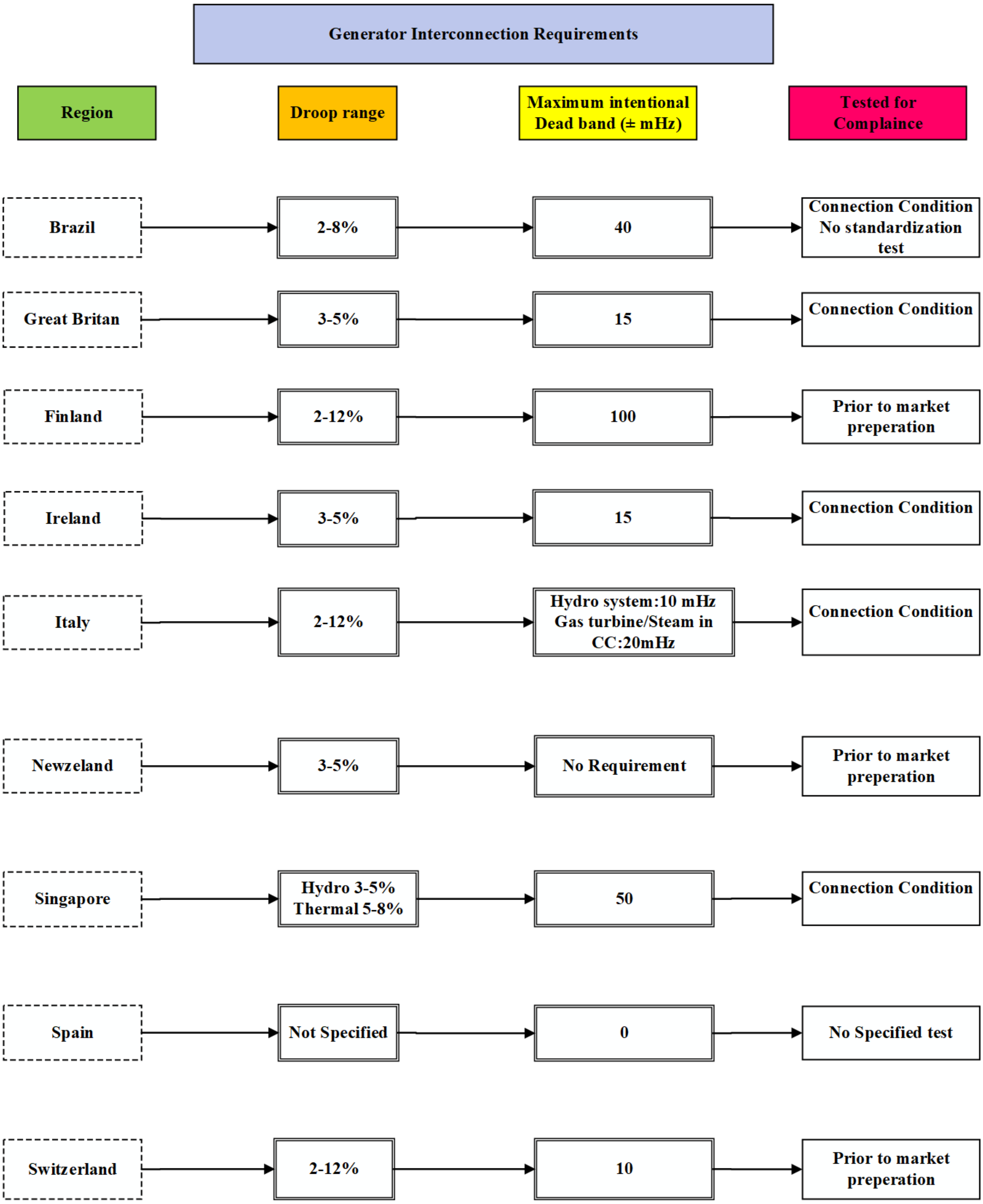

Fig. 19. Primary Reserve Requirements of GC.

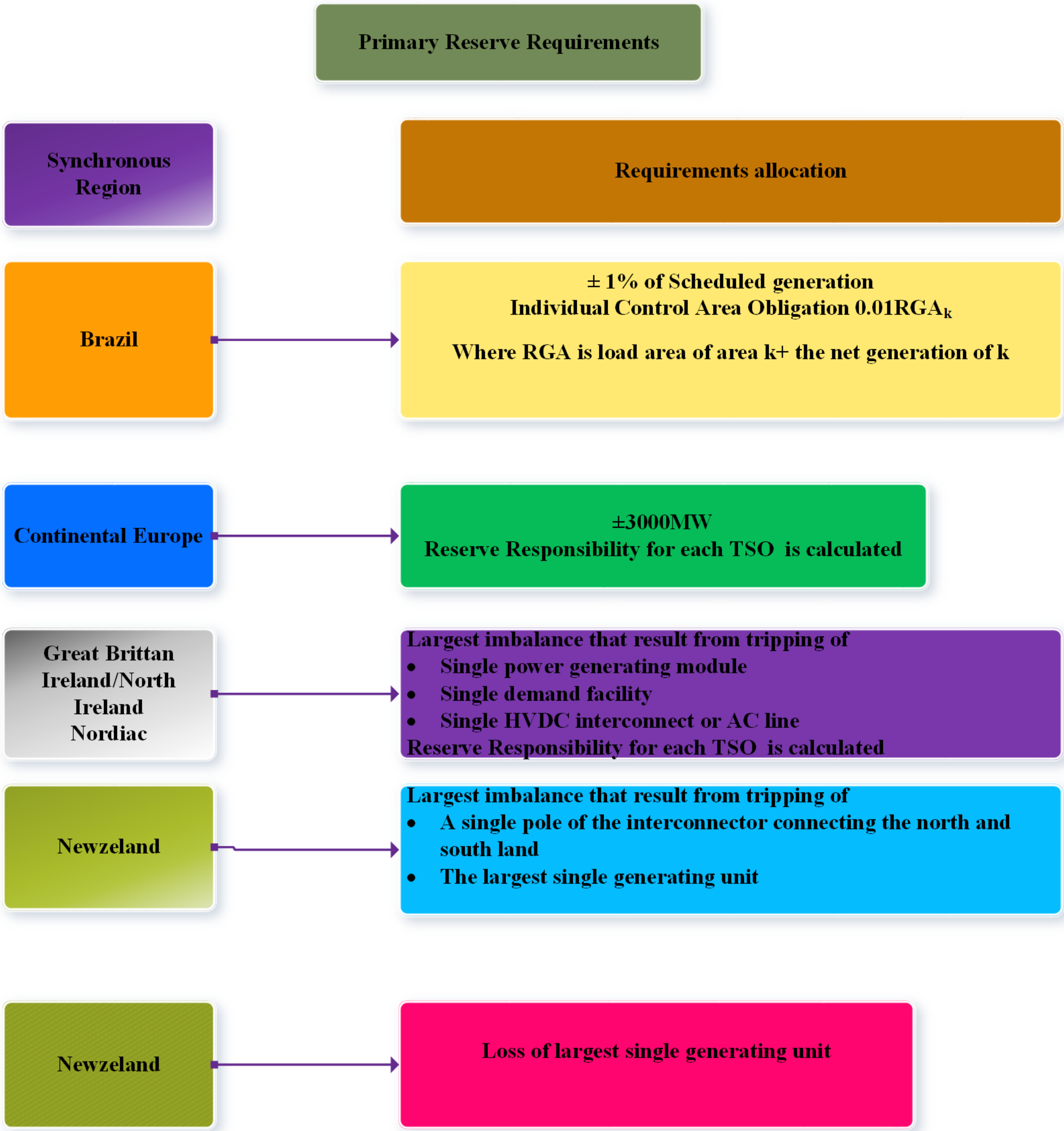

Fig. 20. Generator Requirements of GC [45]

6. Conclusions

This Paper discusses conceptual views on renewable energy sources, the use of unconventional sources and integration, future challenges for renewable energy sources and control strategies for different types of microgrids, and Management energy is also discussed as an inevitable challenge to manage distributed renewable sources connected to the grid. The confront is due to considerations such as the flashing of the source, the prices of the time of day, size of the solar panels, the battery, the battery charge limits and discharge speeds. In this paper, the solutions to meliorate the reliability and enforcement of these systems consists in integrating energy storage device in the power supply network using various control strategies and optimization techniques also discussed.

- Renewable energy sources create new challenges in devising, enterprises of electric power grid.
- To overcome the arguments of voltage rise, voltage swell and protection issues in utility of AC grids solved by "Microgrid (MG)'" and "Smart grids (SG'S)", for future electrical power systems have been recommended and confabulated about AC Microgrid, DC microgrid as well as Hybrid Microgrids.

- The integration of solar energy, wind energy will face the problem of low load levels. The key consideration in making choice of variability, uncertainty of renewable generation is the cost-effectiveness of method and characteristics of existing network system. For profitability, the following solutions are: network infrastructure, operating practices, generation fleet and regulatory structure.
- Various control strategies and optimization techniques were discussed for improvement of energy management system integrated with DC and AC microgrids.
- Grid codes which are used evaluate stability of microgrid are also discussed.

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