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Review On Non Conventional Energy Sources For Power System

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Abstract: The reduction of grid power dependency in remote and rural areas through the use of hybrid energy systems is a vital step toward achieving sustainable energy. These systems combine multiple renewable resources such as wind, solar, and mini-hydro to provide end users with reliable and predictable electricity.

Keywords : HRES, Optimization, Energy , renewable.

I. Introduction :

Recent years have seen a significant increase in worldwide worries about rising energy usage and dependency on fossil fuels. As a result, using renewable energy sources (RES) to produce power is becoming more and more popular. Due to the growing penetration of renewable energy sources and energy management, the power system faces huge challenges.

The current power system architecture can be updated using two-way communication, distributed generation, advanced automated controls, and forecasting systems [2]. By enabling communication between generators and consumers, smart grid technologies enable the most effective use of energy in light of environmental, financial, and technical considerations. The consequence is a more dependable, effective, and secure electrical system [3]. The energy management and demand profile shaping aspects of the smart grid system are quite challenging.

The use of systems and processes to reduce energy requirements per unit of output while maintaining or reducing overall costs of generating the output from these systems is known as energy management. Demand profile shaping is the practise of reducing or adjusting energy usage during periods of high demand or in response to price signals [4, 5]. As a result, it may be possible to minimise the capacity of required standby power sources, lower overall plant and capital costs, and raise system reliability [6].

II. Literature Review :

Hybrid Renewable Energy Systems (HRES),HRES may be formed by combining several renewable energy systems. a review on design and development of hybrid energy systems is discussed. and it also discuss about optimization techniques for hybrid system.

The introduction to a survey of current methods and tools for determining potential and exploitable energy in the most important renewable sectors (i.e., solar, wind, wave, biomass, and geothermal energy), with challenges for each renewable resource highlighted, as well as tools that can assist in evaluating the renewable sources[7]. A detail analysis on optimization techniques is also presented, so as to integrate the system and technique for better performance.

About various schemes used for generating electric power from renewable energy resources trends in optimization techniques used for the designing of hybrid energy systems. And survey on different energy storage system so as to obtain better reliability and stability of power system is reviewed. A review on various important elements needed while designing of hybrid energy system before implementation is discussed.

This hybrid systems effectively address the demerits of the systems which could provide substantial power only during specific periods and seasons. For example, solar power would be much reduced during the night time. Hence hybrid systems effectively counteract this issue as the lack of stability in one system is well compensated by the other. The review, optimized hybrid system with optimization towards maximization of power generated from the system with the help of soft computing technique.

Limited attention was paid to system optimal sizing and techno-economic evaluationof the pumped storage based PV power generation system. A study to optimize the system based on its technical performance and lifecycle cost based on load demand and solar energyresources for a remote island in Hong Kong is proposed. The single-objective and multi- objective optimization method have been employed to obtain the optimal result.

Single-objective optimization, an optimal solution can be obtained. Under the multi-objective optimization, the pareto optimal solution set was obtained based on two indexes[2].Xiang Chen et al propose an optimal algorithm to optimizea hybrid renewable power system, considering the diesel generators as the main control energy source. In this work optimal configuration using HOMER and GA is discussed for modeling the distributed generations, with the control strategy, collecting the weather sourcedata for years, coding the optimization algorithm.

III. **Metaheuristic Techniques:**

The currently used algorithms have been examined. According to the study, it is recognised for the planning and creation of the suggested technique known as a PSO algorithm[8]. A subset of evolutionary computation called evolutionary inspired optimization algorithms draws inspiration from live evolution processes such reproduction, mutation, recombination, natural selection, and survival of the fittest. For resolving issues with optimal power flow, numerous optimization techniques with evolutionary inspiration are applied.

The genetic algorithm is a type of evolutionary algorithm that uses a population of plausible answers to bring those solutions closer to a set of criteria or specifications. This new set of approximations is propagated using operators taken from natural genetics, and it is generated based on their degree of fitness. Each evolutionary stage in the process is referred to as either generation or reproduction. A GA typically works with a fixed-size population of solutions and uses the three genetic processes of crossover, mutation, and selection to alter the solutions chosen from the current generation and select the best progeny to pass on to succeeding generations.

Pattern search is a class of numerical optimization techniques that does not need the use of a gradient, often known as direct search, derivative-free search, or black-box search. As a result, non-continuous and non-differentiable functions may be employed with it[9,10]. One such method for finding patterns is "convergence", which is predicated on the notion of positive bases. Optimization seeks to find the optimal match in a multidimensional analytic space of options (the solution with the lowest error value).

PSO is a metaheuristic in that it can explore enormously broad areas of potential solutions while making little to no assumptions about the problem to be solved. Metaheuristics like PSO, though, do not ensure that the best solution will be found. Additionally, unlike conventional optimization methods like gradient descent and quasi-newton methods, PSO does not use the gradient of the problem being optimised and does not require that the optimization problem be differentiable.The behaviour of actual ants, who reside in colonies and communicate with one another by exchanging pheromones, is the basis for ant colony optimization (ACO) algorithms, which are designed to solve challenging problems like determining the shortest path from the nest to food sources.

IV. **Implementation:**

The PSO algorithm is founded on the idea that complex behaviour may be predicted by a few basic principles.

- It employs a swarm of agents (particles) that move about in the search space in quest of the optimum answer.
- Each particle is regarded as a point in an N-dimensional space that modifies its "flying" based on its own as well as other particles' flying experiences.
- Each particle maintains track of its coordinates in the solution space, which are linked with the particle's best solution (fitness) thus far. Personal best is the name given to this value .
- The best value achieved so far by any particle in the vicinity of that particle is another best value monitored by the PSO. This value is referred to as global best .
- The fundamental idea behind PSO is to accelerate each particle toward its Personal best and global best positions at each time step using a random weighted acceleration.

Explanation of Process

The PSO algorithm updates the velocity vector for each particle, which is subsequently added to the particle's position or value. Impact velocity updates are the best local solution associated with the lowest cost in the current population and the best global solution associated with the lowest cost ever discovered by a particle[11]. If the best local solution is less expensive than the best global response, the best local answer will take its place. Velocity is comparable to local minimizers that employ derivative information since velocity is the derivative of position. PSO only requires a few settings to be adjusted and is easy to set up. Additionally, it can manage complex cost functions with numerous local minima.

PSO is yet another type of stochastic evolutionary algorithm used for optimization. Based on prior knowledge (best fitness parameters), information shared with neighbours (best fitness of other particles), and stochastic shifting of the movement direction, this method involves transferring particles from candidate solution space to search space[12]. Both continuous and binary or discrete issues can be handled by the PSO approach. It was influenced by flocking birds social dynamics.

The PSO algorithm is simple to use and generates the best results rapidly. With the current optimal particle as their guide, PSO's swarms of particles or swarms, each of which is identified by its location and velocity vectors, move through the search space[13]. A vector that describes the speed of a swarm of particles in each direction is used to characterise their motion. The term "particle experience" refers to the best solution identified thus far for each particle, which is recorded in a particle memory. Moreover, the best particle or social leader among all particles represents the finest resolution thus far. The social leader and each swarm's experience both influence how quickly and where it moves.

Conclusion :

This research presents a strategy for optimum scaling of stand-alone hybrid PV/wind/battery/diesel energy systems using PSO. The optimization objective was to reduce system costs while maintaining load demand and adhering to a number of optimization restrictions.

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