Utilization of renewable energy sources in generation and distribution optimization

G. Balram¹, S. Anitha² and A. Deshmukh³

¹Department of Electrical and Electronics Engineering, S R Engineering College, Warangal, Telangana, India. Pin: 506371.
²Department of Electrical and Electronics Engineering, Sumathi Reddy Institute of Technology for Women, Warangal, Telangana, India. Pin: 506371.
³Department of Electronics and communication, KLS Gogte Institute of Technology, Belgaum, Karnataka, India. Pin: 590008

Email: g.balram@sru.edu.in

Abstract. Renewable energy is natural energy source, clean, affordable, and effectively infinite. It results in pollution free air and no harmful waste. The benefit of renewable energy doesn’t deplete where in case of fossil fuels happens. Here Fossil fuels prescribed and will be not their availability, but the same thing will not get with these natural sources like wind and solar because Sun will continue to bright, wind also continue to blow for sure. These generation systems now giving assurance and the great beneficial renewable energy methods. As per updates wind power industry is simply one of the fastest updated expanding industries because of huge growth of installed capacity. Hybrid wind-solar system fastest expanding industries because of rapid growth of existing capability. These sources when acting solo can oscillate, when combined both provides a continue generation of source. The suitable mitigation is to add both the renewable sources to get uninterrupted supply. This paper reveals how a standalone act in hybrid power generating system which contains of solar-wind hybrid power system and to strengthen benefit of natural energy creating system to reduce the entire cost of the method.

Keywords. Natural sources, Optimization, Hybrid energy storage, fossil fuels.

1. Introduction
The renewable energy natural sources together namely wind & solar are preferred in power generation termed as hybrid-wind-solar system [1]. This module specially made by taking the solar panels associated with less rating wind turbines for generating source as electricity. To get the sufficient knowledge about the solar wind hybrid system working process, we should be familiar with the working process of both solar and wind energy systems when acting separately. As we know Solar power system nothing but the system that takes solar energy for electrical energy generation by the use
of solar panels. Let will consider by taking the diagram which show how the working of solar panels at the same time wind system turbine also for generating heavy demand electrical source power [2–4].

![Wind turbine generating power illustration.](image)

**Figure 1.** Wind turbine generating power illustration.

1.1. **Wind power**
Wind energy is the available source in nature which also used to develop source as electrical energy where wind turbines mechanically coupled with generators. Wind turbine is simply a fan which have two or three blades just for rotation because of blowing wind therefore the axis of rotation definitely aligned along the direction of how the wind is blowing. A high precise mechanical energy system used which uses gear box for energy conversion only mechanical as median and done by device to device [5]. There exists huge number of wind turbines, but most frequent used wind turbines named 1. horizontal and 2. vertical axis turbines.

1.2. **Solar power**
Solar energy system has three main different blocks called solar system panels, solar energy photovoltaic cells, finally for storing the generated energy batteries. After generation of DC power by solar system panels can stores in batteries and utilizes to supply DC loads and which uses for inverters to satisfy AC loads. As we know Solar Energy drawback only present in daytime, but the advantage of wind energy is always present in entire day based on climate situations [6].

1.3. **Hybrid solar-wind system**
Both the natural energy sources are complementary wind and solar, this is one advantage to generate electrical energy in entire year. The important parts of the Wind-Solar Hybrid energy System are charge controller, tower, photovoltaic panels, for storage batteries, conducting materials like cables, wind aero generator and finally inverter to satisfy AC loads [7]. This combined version of Wind Solar Hybrid module generates high demand electrical energy that available for charging the batteries and with additional benefit of inverter to satisfy AC Load demand. Here Wind aerogenerator also placed on a tower with minimum height of eighteen meters which measured from ground level. This consideration of the height, the aerogenerator generates highest power because it takes higher speed wind.

2. **Optimization**
The term optimization is simply a process, involve or adopting of making system design or conclusion functional or strengthen as possible. There are two methods of optimization present namely first one metaheuristics and the second one simulation Which results in another solution with the greatest improvement score and highly cost effective based on few constraints where increasing desired constraints and decreasing the undesired factors. However, maximization describes an effort to reach desired efficient system improvement, reliability results regardless of cost and this perception is same which has been verified [8–10]. Due to lack of overall data and its information existing optimization may be restricted, whereas there is availability of few data while remaining not therefore linear programming directly applied. Conversely, the optimal changing dimensions of natural renewable
energy module components to strengthen their energy easily, capable or its performance, thus, supplying power, continues process is considered i.e., effective Reliability optimization. Its Results in Power system with its hybridization nothing but an infrastructural planning exploration with the supporting optimization tools to implement renewable source energy elements to derive the power reliability reaches almost zero or very fraction loss of power supply probability (LPSP).

![Figure 2. Advantage India demand of solar.](image)

![Figure 3. Solar panels generating power illustration.](image)

Probability in easy way is of getting optimal continuous power supply, and, notwithstanding everything depends on the power system supply design redundancy updates. Redundancy of electrical power elements can either be completely active or only partially active when working along system design to accept smooth power system supply distribution without any disturbance. Similarly, here Passive tells that the elements are on standby and are only engaged when fault occurs. Subsequently, the reliability with the active redundancy has delicate power supply which do not allow loss of any power or allows only very less loss than the reliability passive redundancy element [11].
3. Analysis
In entire world India occupied 4th greatest place in the sector of renewable energy market and also 5th ranked in the field of installed energy strength by Oct 2018. India also 2nd among all the emerging economies to lead to transition to clear and clean energy by the report of climate scope India ranking. The renewable energy generation capacity has strengthened at a fast rate over the past few years, posting a 19.78 percent CAGR between FY14 to 18. With the encouragement of government and improved economics, this field has become best advantage from investors point of view. Now India reaches to its target of near 15,820 TWH by end of the year’2040, where renewable energy is plays an important role [12]. As per Paris Agreement commitments, the Indian Government has set an ambitious target to reach 175 GW of renewable energy capacity by the year of 2022. Which also include solar capacity of 100 GW and wind power capacity of 60 GW. Its decided that Indian Government plans to generate capacity of 500 GW renewable energy by the year 2030.

4. Results and discussion
The graphical output concludes only normal output with the growing in number of cost and erases all other infeasible possible solutions. Also, simulation performs the number of parameters displayed versus smooth changing parameters to get optimal solution for energy system. The Monthly Average Electricity Production of Hybrid Energy System as shown. According to the optimal solution the total energy required to satisfy the load demand by the hybrid. This hybrid system compared with time and how its developed by the years as shown. We will get continuous generation for increased demand and pollution free [13-16].
Figure 5. Average hourly based comparison.

Figure 6. Various load profiles.

Figure 7. The average consumption of load.
Figure 8. Wind-solar power generation in March.

Figure 9. Solar-wind capacity graphs.
Wind or solar power both were cannot be the single energy source of electricity in a stable base-load grid, but which can decrease the use of conventional energy sources. Here the avoided emissions results advantage to environment. All conventional types of power plants produce pollution per every kwh generated electricity. In case of Solar wind system produces zero pollutant emissions because of avoidance of emissions [17-20].
5. Conclusion
The natural renewable energy systems alone cannot produce a continuous electrical energy source, as they are atmosphere dependent. In case of implementation of hybrid system of wind in parallel with solar to identify the standard of each method, here in mean time slowing the weaknesses of every system alone, to produce a balanced process to generate the energy. Really power module cost is reduced but which is different for all the localities because to the fluctuation of the solar or wind energy as sent. In India, there will be major wind companies are shifting portion of their concentrate to solar wind hybrid system due to the fluctuations of advantages here brought. Remember electrical energy generated with the solar in parallel with wind hybrid system is economical than isolated sola power systems or wind power systems.

As per the analysis globally concern the security of energy and the sustainable improvement in overall globe. Here renewable energy has more efficient and affective role. The developed system encouraging renewable energy sources instead of using fossil fuel. The various factors in economic discussed with hybrid wind or solar systems.

6. References
[1] Ahlstrom M, Ela E, Riesz J Sullivan J, Hobbs B F, Malley M O, Milligan M, Sotkiewicz P and Caldwell J 2015 The evolution of the market: designing a market for high levels of variable generation IEEE Power and Energy Magazine 61 65-69
[2] Ackermann T, Prevost T, Vittal V, Roscoe A, Matevosyan J and Miller N 2017 Paving the way a future without inertia is closer than you think IEEE Power and Energy Magazine 15(6) 61–69
[3] Helisto N, Kiviluoma J and Holttinen H 2017 Sensitivity of electricity prices in energy only markets with large amounts of zero marginal cost generation International Conference on the European Energy Market 10.1109/EEM.2017.7981893
[4] Bodgan S, Borowy, Ziyad M and Salmesh 1996 Methodology for optimally sizing the combinations of a battery bank in a wind/PV hybrid system IEEE Transaction on Energy Conversion 11(2) 367-373
[5] Al-Masri H M and Ehsani M 2016 Feasibility investigation of a hybrid on grid wind photovoltaic retrofitting system IEEE Trans. Ind. Appl. 52(3) 1979-1988
[6] Singaravel M M R and Daniel S A 2015 MPPT with single dc to dc converter and inverter for grid-connected hybrid wind-driven PMSG PV system IEEE Trans. Ind. Electr. 62 4849-4857
[7] Dong-Min Miao and Jian-Xin Shen 2013 Comparative study on permanent magnet synchronous generator systems with various power conversion topologies *Fourth International Conference on Power Engineering Energy and Electrical Drives* 1738-1743

[8] Arulmurugan R 2018 Photovoltaic powered transformer less hybrid converter with active filter for harmonic and reactive power compensation *Transactions on Electrical Engineering, Electronics, And Communications* 16(2) 44-51

[9] Golestan S, Guerrero J M, Vasquez J, Abusorrah A M and Al-Turki Y A 2019 A study on three-phase fls *IEEE Trans. Tower Electron* 34(1) 213–224

[10] Kumar N, Hussain I, Singh B, and Panigrahi B K 2018 Implementation of multilayer fifth-order generalized integrator-based adaptive control for grid-tied solar PV energy conversion system *IEEE Trans. Ind. Inform* 14(7) 2857–2868

[11] Rajababu D and Raghu Ram K 2019 Voltage control strategy for three-phase inverter connected standalone wind energy conversion systems *International Journal of Innovative Technology And Exploring Engineering* 8(11) 2164-2168

[12] Shiva C K, Vedik B and Kumar R 2019 Integration of distributed power sources to hydro-hydro power system subjected to load frequency stabilization *International journal of engineering and advanced technology* 8(2) 128-133

[13] Mudi J, Shiva C K, Vedik B and Mukherjee V 2020 Frequency stabilization of solar thermal-photovoltaic hybrid renewable power generation using energy storage Devices *Iran J Sci Technol Trans Electr Eng.* https://doi.org/10.1007/s40998-020-00374-w

[14] Vedik B, Shiva C K and Harish P 2020 Reverse harmonic load flow analysis using an evolutionary technique *SN Appl. Sci.* 2 1584 https://doi.org/10.1007/s42452-020-03408-4

[15] Vedik B, Ritesh K, Deshmukh R and Shiva C K 2020 Renewable energy-based load frequency stabilization of interconnected power systems using quasi-oppositional dragonfly algorithm *J Control Auto Electr Syst.* https://doi.org/10.1007/s40313-020-00643-3

[16] Kumar R, Sahu B, Shiva C K and Rajender B 2020 A control topology for frequency regulation capability in a grid integrated PV system *Archives of Electrical Engineering* 69(2) 389-401

[17] Vedik B, Naveen P and Shiva C K 2020 A novel disruption based symbiotic organisms search to solve economic dispatch *Evol. Intel.* https://doi.org/10.1007/s12065-020-00506-5

[18] Kumar C N and Satyanarayana N 2015 Hybrid loss recovery technique for multipath load balancing in MANETs *2nd International Conference on Electronics and Communication Systems ICECS 2015* 1294-1301 10.1109/ECS.2015.7124793

[19] Sekhar V M Rao, KVG Rao N S and Chand MG 2016 Comparing the capacity NCC and fidelity of various quantization intervals on DWT *Advances in Intelligent Systems and Computing* 413 45-55 10.1007/978-981-10-0419-3_6

[20] Seena Naik K and Sudarshan E 2019 Smart healthcare monitoring system using raspberry Pi on IoT platform *ARPN Journal of Engineering and Applied Sciences* 14(4) 872-876