

Renewable Energy Systems & their Suitability in Rural Areas

Manikant Kumar¹, Dr .Pratibha Tiwari²

- Ph.D scholar Department of Electrical Engineering Sam Higginbottom Institute of Agriculture and Technology Science Allahabad (India)
- Assistant Professor Department of Electrical Engineering Sam Higginbottom Institute of Agriculture and Technology Science Allahabad (India)
Corresponding Author: Manikant Kumar

Abstract:- This paper introduces a Renewable vitality framework by us of wind, Solar, Biogas vitality System. The most much of the time utilized sustainable power sources are wind turbine and Solar vitality. Staggered inverters assume an essential job in the present interconnected lattice frameworks with sustainable power sources. Those power hardware gadgets which changes over DC input capacity to AC required yield level of voltage and recurrence are known as inverters. Because of the way that sunlight based, biogas and wind control is spasmodic and eccentric in nature, higher infiltration of them composes in existing force framework could cause and make high specialized difficulties particularly to powerless networks framework. By incorporating the two sustainable assets into an ideal blend, the effect of the variable idea of sun powered and wind assets can be somewhat settled and the general framework turns out to be more dependable and practical to run. Staggered inverter can be utilized with this independent framework for the jolt of country regions to give continuous power supply.

Date of Submission: 15-12-2018

Date of acceptance: 31-12-2018

I. Introduction

In present situation India has been developing economy with normal GDP development rate anticipated around 7.1 % over the post decades, still the advancement part of provincial regions is yet disturbing. Despite the fact that nation have an immense hydroelectric potential yet because of real stream water circulation clashes these can't be tackled. In this manner, all together advance the improvement in remote zones there is prerequisite to build up a manageable and effective vitality framework to manage the steady power issues in these territories. With front line development in sustainable power source part these can be seen as a potential answer for current circumstance, contaminate half and half frameworks could be look an earlier forward as answer for sort of issues. Inverters are those contraptions which changes over DC ability to AC control at needed yield voltage. Close to this it has some different favorable circumstances, for example, high power quality, bring down request music, bring down exchanging misfortunes, and better electromagnetic obstruction and recurrence. Yet, it has a few drawbacks additionally like high exchanging misfortunes, staggering expense and less effectiveness. Consequently, in view of these impediments staggered inverters are utilized over customary inverters. The yield of the staggered inverter is staircase waveform which is like sinusoidal waveform. The quantity of sounds present in the yield voltage of staggered inverter is substantially lesser than the regular two-level inverter.

Built up and assessed limit of Renewable power sources in India

Renewable Sources	Built up (MW)	assessed limit
Wind power	34,046	60,000
Solar power	21,651	1,00,000
Biomass power	8,701	9,000
Waste-to-Power	138	1,000
Small hydropower	4,486	5,000

Scope of Work

Presently, researchers and designers around the world have been supporting the usage of sustainable power source assets. Science these are copious, however weaken and variable, locally accessible, nearly and don't sully the earth, effortlessness in on location age. Since, it is weaken and variable in nature, numerous complexities exist in transformation, condition, control, coordination and so forth. They are used as an independent framework serves numerous applications i.e. lighting framework, water pumping for water system, movement control and so forth. Be that as it may, it is expensive, questionable, and requires singular molding and controlling units. In this testing environment, Hybrid Energy System (HES) is one of the practical answers for reap vitality from sustainable power source assets.

Overview of Hybrid Renewable Energy Systems

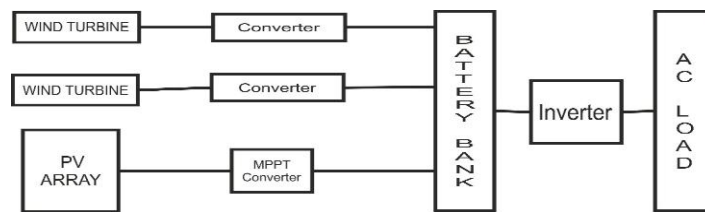
Hybrid energy system usually comprises of two or more renewable energy sources combined in such a way to provide an efficient system with uninterrupted power supply. In other words it can be said that hybrid energy system is a combination several (two or more) energy sources with appropriate energy conversion technology connected together to feed power to local load/grid. Since, it is categorized as a distributed generation system hence there is no unified standard or structure. It is beneficial in terms of reduced line and transformer losses, reduced environmental impacts, relived transmission and distribution congestion, increased system reliability, improved power quality, and increased overall efficiency.

Types of Hybrid Renewable Energy Systems

Biomass-wind-power device: consider a heap of 100% power supply and there is no inexhaustible framework to satisfy this need, so at least two sustainable power source framework can be joined. For instance, 60% from a biomass framework, 20% from a breeze vitality framework and the rest of energy units. Consequently, consolidating all these sustainable power source frameworks may give 100% of the power and vitality prerequisites for the heap, for example, a home or business.

Photovoltaic-wind

Another case of a mixture vitality framework is a photovoltaic cluster combined with a breeze turbine. This would make more yield from the breeze turbine amid the winter, though amid the late spring, the sunlight based boards would create their pinnacle yield. Half breed vitality frameworks regularly yield more prominent monetary and natural returns than wind, sun powered, geothermal or trigeneration remain solitary frameworks independent from anyone else.



Block diagram of a PV/ wind hybrid energy system

Completely Renewable Hybrid Power Plant: Totally Renewable Hybrid Power Plant (sun powered, wind, biomass, hydrogen) a half and half power plant comprising of these four sustainable power sources can be made into task by legitimate usage of these assets in a totally controlled way.

Hydro-wind: A breeze hydro framework creates electric vitality consolidating wind turbines and pumped stockpiling. The blend has been the subject of long haul dialog, and a test plant, which likewise tried breeze turbines, was executed by Nova Scotia Power at its Wreck Cove hydro electric power site in the late 1970s, yet was decommissioned inside ten years. Since, no other framework has been executed at a solitary area starting late 2017.

Photovoltaic-Biomass: this is a mix of biomass gasifier and sunlight based photovoltaic cells and the framework is as of now under research stage.

Advantages and Limitations

Hybrid Energy Systems utilizes an extensive variety of essential vitality sources, for regular inexhaustible sources age as the remain solitary framework for country charge where network expansion isn't conceivable or uneconomic. Plan and improvement of different HES parts has greater adaptability for future augmentation and development. Number of age units can be expanded with interest to guarantee steady activity with existing framework. On the off chance that there is overabundance age than interest, it very well may be feed in to framework which prompts income age. Since numerous sources are engaged with power age, its strength, dependability and productivity will be high. Running expense of warm plant and nuclear plant is high. Greater part of the sustainable source based power age has least running expense additionally plentiful in nature. While constraints of crossover sustainable power source frameworks can be clarified as under.

Maximum power extraction: At the point when distinctive V-I qualities voltages are associated together, one will be better than other. In this situation, extricating most extreme power is troublesome for a consistent load. Stochastic Nature of sources: These circulated sources are site particular and weakened. In this way, the outline of intensity converters and controllers must be so intended to meet the necessity. Complexities in coordinating

voltage and recurrence level of both reversed DC sources like PV framework, power device, and so on controlled AC sources like breeze, hydro, and so on. Since if there should arise an occurrence of these sources V-I attributes relies upon air condition, or, in other words to time. Anticipating of these sources isn't exact. Coordination: In request to get dependable power, these frameworks can be associated with an utility lattice. Frequently recurrence befuddle emerges between the two frameworks. Consequently it drives unsteadiness of the general framework.

Energy Conversion Technology: Sun is the essential wellsprings everything being equal. It is accessible from multiple points of view like oil, coal, wind, hydel, daylight. In current time we are creating electrical vitality from these sources specifically or by implication. Up until now, there is no special reasonable strategy is utilized for transformation and use.

Power Quality:

- Economic aspects: Net Present Cost (NPC) is a summation of all costs: capital investment, non-fuel operation and maintenance costs, replacement costs, energy costs (fuel cost plus any associated costs), any other costs such as legal fees, etc. On the off chance that various choices are being viewed as then the choice with the least Net Present Cost will be the most positive monetary alternative. Cost of Energy (COE) is an estimation of the expense of creating power at the purpose of association with a heap or power matrix. It incorporates the underlying capital, rebate rate, and also the expenses of consistent task, fuel, and support. Inward Rate of return or monetary rate of return (ERR) is a rate of return utilized in capital planning to gauge and look at the productivity of ventures.
- Specialized factors: Supply unwavering quality: A vitality source is viewed as solid on this site in the event that it very well may be utilized to create a reliable electrical yield and is accessible to take care of anticipated tops in demand. Each vitality source has qualities and shortcomings, for example, its natural impediments on dependability of supply, which could add to the probability of a vitality hole, when supply misses the mark regarding request, and may make interferences the power supply. Battery throughput: it is the proportion of the execution and capacity limit of a battery that is utilized for a particular reason. Territory of Charge of the batteries (SOC): is what might as well be called a fuel measure for the battery pack in a battery electric vehicle (BEV), half and half vehicle (HEV), or module mixture electric vehicle (PHEV). The units of SOC are rate focuses (0% = void; 100% = full). A substitute type of a similar measure is the profundity of release, the reverse of SOC (100% = vacant; 0% = full). SOC is ordinarily utilized while talking about the present condition of a battery being used. Rate of charge of the hardware, Excess of Electricity (EoE) and Grid association prerequisites if accessible.
- Environmental factors: Renewable Fraction (RF), CO₂ emissions and site conditions. Others less studied are related to the legal framework and the subsidies/penalties associated with the generation technologies or differences among countries. After defining the criteria to be considered, the main optimization principle in the objective function might be as diverse as: minimum cost, maximum financial viability, minimum CO₂ emission, minimum investment and/or maintenance cost (through life cycle analysis), minimum annual fuel cost, maximum continuity of supply, unmet load, etc [8]

Methodology for the design of hybrid renewable power systems depending on availability of energy sources and load characteristics is a primary point of concern. Further exhaustive research is also required for multi-objective optimum designs of hybrid systems. The importance of considering other criteria besides the cost is clear. From the analysis of case studies conducted earlier, an increase of only 1% in the optimum cost of the system almost doubles the fraction of renewable resources up to 47% [7]

Suitability of System

Provincial territories in India adds up to about aggregate land zone of nation and around 75% of populace of nation dwell in these regions. The living condition here are extremely undesirable and individuals need here fundamental offices like power, water supply, training, streets and so forth. Inorder to bring individuals living in these regions in standard and to keep expansive scale relocation from these zones to metropolitan urban communities we have to build up a few sources that can satisfy their fundamental needs among them indispensable grouping to be power. What's more, for this situation crossover sustainable power source frameworks can turn out to be a noteworthy bleeding edge answer for these issues. Underneath we have characterized the reasonableness of different systems in half and half sustainable power sources could demonstrate to an answer and in what kind of area based on land example and area of that specific district.

Future Trends and challenges for research

The sustainable advances have progressed significantly as far as innovative work. Anyway there are as yet certain deterrents as far as their effectiveness and ideal utilize. Following are the difficulties looked by professionals.

- The sustainable power sources, for example, sun based PV and FCs, require creative innovation to saddle more measure of valuable power from them. The poor productivity of sun powered is real check in empowering its utilization.
- The assembling cost of sustainable power sources needs a noteworthy decrease in light of the fact that the high capital cost prompts an expanded recompense time.
- It ought to be guaranteed that there ought to be negligible measure of intensity misfortune in the influence electronic gadgets.
- The capacity advances need to build their life-spin through imaginative innovations.
- These remain solitary frameworks are less versatile to stack variances. Substantial variety in load may even prompt whole framework crumple.

II. Conclusions

Despite the fact that half and half vitality frameworks could be potential answers for the power issues in the rustic district yet huge research is required in this perspective to make it in fact possible to be utilized at these areas. The prime focal point of study ought to be the expense of the framework and its yield. This examination presents eight sustainable advances that can supplement the urban power supply. It has been beforehand assessed the capability of its application in various urban communities, yet it is mirrored that self-age inside a city has its constraints, and will rely upon the accessible asset, kind of utilization per occupant, social adequacy or states of execution of the gear. Additionally, there are specialized states of every one that, despite the fact that they have achieved their phase of business development, their application will be identified with the advancement of shrewd systems in disseminated age. Expanded urbanization will require a consistent supply of vitality. Notwithstanding, as the present vitality framework is considered, it will be probably not going to give nonstop here and now supply. The aim is that, urban arranging incorporate measures for these innovations to be bit by bit acknowledged, as indicated by indigenous assets and conditions. It is suggested that vitality arranging be extended at the city level and not be elite to a nation or area. Complete urban vitality arranging requires from one viewpoint distinguishing inexhaustible potential and potential uses as per existing innovation. The different criteria choice investigation strategies, permit contrasting an arrangement of options by assessing an arrangement of criteria that can be subjective or quantitative. After a composition look for, fourteen criteria (5 Technical, 3 money related, 3 common, 3 social) were portrayed. A few multicriteria techniques have been proposed, the outcomes acquired by applying every one of them may vary, however that does not imply that the arrangement is mistaken, on the grounds that every strategy works in an unexpected way. In this exploration was connected the PROMETHEE technique, which permits a positioning of the options. Consequently, the leader can choose the most suitable sustainable innovation dependent on the set up criteria. Under this methodology the innovations that can be connected in the city of Cuenca (Ecuador) was resolved. Contingent upon the level of inclination they are: sunlight based photovoltaic, hydropower, landfill biogas, biomass, biogas, wind, cremation. It was discovered, that the favored options depend principally on the specialized, social and monetary criteria. With the above it is finished up, that a change a vitality demonstrate dependent on imports of assets from outside of the city, and that think about sustainable power source, will require an all-encompassing examination, to characterize what the most proper choices for a given city.

Reference

- [1]. Ministry of Finance report 2017
- [2]. India Infrastructure report 2018
- [3]. Chedid R, El Khoury H. Design of a Hybrid Wind-PV-Fuel Cell System for Powering a Desalination Plant. 2007 IEEE Power Engineering Society General Meeting [Internet]. Institute of Electrical & Electronics Engineers (IEEE); 2007 Jun; Available from: <http://dx.doi.org/10.1109/pes.2007.385440>
- [4]. IEEE Power and Engineering Society-General Meeting Feb.9.2011, Arpa-E, Doe USA, MSE Italy, European Commission-EnergyCaffese plan and Consortium
- [5]. Elistratov V.V. Hybrid system of Renewable Energy Sources with Hydro Accumulation
- [6]. Rekioua D, Matagne E. Hybrid Photovoltaic Systems. Green Energy and Technology [Internet]. Springer Science + Business Media; 2012;223–73. Available from: http://dx.doi.org/10.1007/978-1-4471-2403-0_7
- [7]. Li C-H, Zhu X-J, Cao G-Y, Sui S, Hu M-R. Dynamic modeling and sizing optimization of stand-alone photovoltaic power systems using hybrid energy storage technology. Renewable Energy [Internet]. Elsevier BV; 2017 Mar;34(3):815–26. Available from: <http://dx.doi.org/10.1016/j.renene.2008.04.018>
- [8]. Sreeraj, E.S. et al., "Design of isolated renewable hybrid power systems". Sol. Energy (2017).

Manikant Kumar. "Renewable Energy Systems & their Suitability in Rural Areas" International Journal of Engineering Science Invention (IJESI), vol. 07, no. 12, 2018, pp 43-46