



## Literature survey on solar and wind energy

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### Abstract

"ENERGY" the word on which the whole world works. Each and every substance in this world either living or non-living required energy to perform their task. Humans in different eras found new sources of energy to make their work simpler, however now there is need to rethink over the sources of energy due to adverse effect by massive consumption of conventional energy sources. These conventional energy sources degrades environment by increasing carbon emission or we can say that by increase in greenhouse gases, which makes environmental health vulnerable. There is a need to develop the method to counter environmental degradation by developing the means of sustainable development.

**Keywords:** solar energy, wind energy

### Introduction

The utilization of renewable source of energy is one of the methods for the environmental conservation. There are basically three primary motivator that simulates the development of renewable energy: energy security, energy impact and reduction of carbon dioxide emission. In the present scenario Solar energy is one of the best renewable source of energy which stands good for all these three pillars. Solar energy was invented in 1954 by three partners Gerald Pearson, Calvin Fuller and Daryl Chapin<sup>[1]</sup>, 13 years after the invention of solar cell. Now there are various technologies had been developed for the exploitation of solar energy? Here we will discuss various ways in which solar energy can be utilized as a cleaner fuel for daily usage.

Terzioglu, H *et al.* (2015) discussed One of the most essential components of solar energy is the solar panel. The paper here discusses the possibility of installing the solar panels in a different manner. Considering the limitations of various other types of renewable energy sources the solar energy is clearly the best method to produce electricity.

In this paper author proposed to use the panel in a non-conventional manner and using it in two different approaches. One of the approaches is used to power the instantaneous electricity needs while the other is used to charge batteries for future needs. The proposed method uses lesser number of solar panels and lesser batteries thus reducing cost of the system. The paper also presented the application of this design in a village Konya where the approach was very successful.

Christian k. Jørgensen in 1980 in a book chapter on "Quantum Harvesting And Energy Transfer"<sup>[9]</sup> says Sun provide energy used by plant and animal by emitting a standard continuous spectrum of an opaque object at temperature of 5750 K. The excited state of uranyl ion is as oxidizing as fluorine as a result of which it performs complicated photochemical reaction with organic molecule starting with abstraction of hydrogen atom. Under quantum chemistry we have developed

a broad rationalization of origin of the absorption band in several categories of transition. Differing with radiation energy of the sun the excitation of atom in different compound differ according which make difference in storage capacity of sun energy in stable form. Thus quantum harvesting can be done by specifying the purpose and accordingly selecting the compound so that maximum utilization of the energy can be possible.

M. K. Nazeeruddin (2011) described that sensitized solar cell is third generation photovoltaic cell and is dye sensitized and converts any amount of visible light into electrical energy. The dye used in the cell is made of photoactive material and when it is sensitized by light it can produce electricity once. The dye acts just like chlorophyll which catches photon and uses their energy to excite electrons, after this dye injects this excited electron into the Titanium dioxide it is conducted away by the Nano crystalline titanium dioxide. A chemical electrolyte closes the circuit so that the electron return back to the dye, as a result of movement of this electron, energy is created which is harvested into rechargeable battery. Hence in this way dye sensitized solar is fabricated.

M.Y.A. Raman (2015) described how Dye sensitized solar cell is dependent on the liquid electrolyte limitation and restriction on expanding the solar cell module fabrication. The reduction of efficiency is the consequence of electron recombination in semiconductor-liquid electrolyte interface, another major problem using liquid electrolyte was that photo anode in contact with the volatilization of Redox electrolyte solution that effect the charge distribution at semiconductor electrolyte interface, and initiated photo corrosion on photo anode. The ionic conductivity in polymer material complex with salt gives breakthrough to this problem thus developing more efficient dye solar cells.

Detlef bahnemann (2004) described that Photo catalysis as one of the most advance technologies and advanced oxidation process that focuses on important mechanistic and kinetic

aspects for the degradation of organic pollutant in water and air. Since high cost is associated with the effective photo catalysis so the commercialization has not happened to great extends. Various solar reactors for photo catalytic water treatment are described including their comparison of overall performance.

Adochitei, M. *et al.* (2014) work here showcased how it was very difficult to remove active substrate which gets deposited upon the solar panel surface without altering the integrity of the surface. To prevent deposition of unnecessary substances on the panel it was suggested to place two vertical solar panels side by side of a 45 degree geometrical mirror prism, where the prism is used to distribute the light coming from sun perpendicularly and parallel.

Pingel, S. *et al.* (2010) describes that It is often observed that the solar panels are often exposed to high voltages with respect to ground which induces high voltage stress (HVS) in the panels. Due to this HVS various types of potential induced degradation (PID) occur.

A lab test to determine PID's in a system has been shown along with some major steps to prevent PID's have also been discussed in the work presented.

Zenan, A.H. *et al.* (2013). Described that use of solar energy in high rise buildings is now being practiced much often than any past times. The proposed work here places 3 panels one over another placed with a minimum distance to avoid shadows over one another. The panels are fitted with micro sensors enabling them to adjust with the sun rays. The newly proposed system was practiced and it was found that this particular placement provided an improved efficiency of 33% in comparison to conventional placement of three panels. The advantages of this system were also highlighted most important being that this placement method required very less space in comparison to the older methods.

### Wind Energy

Broadly speaking wind energy can be defined as the ability of the turbine to operate and generate energy using the flowing wind. Wind turbines can be operated using the flowing wind in regions with high wind speeds.

The technology of wind energy made its first actual steps centuries ago. however, simpler wind devices emerged thousands of years ago with the vertical axis windmills found at the Persian-Afghan borders around 200 BC and the horizontal-axis windmills of the Netherlands and the Mediterranean following much later. Evolution and perfection of these systems was performed in US during the 19th century, and more than 6 million of small machines were used for water pumping between 1850 and 1970.

The most important milestones in the history of wind energy history is that it coincides with the involvement of USA government in the wind energy research and development (R&D) which happened after the oil crisis of 1973. In the years between 1973 and 1986, the commercial WT market evolved from domestic and agricultural (1e25 kW) to utility interconnected wind farm applications (50e600 kW). In this context, the first large-scale wind energy penetration outbreak was encountered in California, where over 16,000 machines, ranging from 20 to 350 kW (a total of 1.7 GW), were installed between 1981 and 1990, as a result of the incentives (such as

the federal investment and energy credits) given by the USA government.

According to the latest official data <sup>[11, 14]</sup>, the global wind power capacity increased during 2009 by 37.4 GW, thus reaching to a total of approximately 158 GW. The remarkable development rates were exhibited for the past twenty years. Europe is at the moment heading to offshore applications. since the mid-90s the EU market corresponds to over 50% of the global installed capacity that is nowadays said to yield an overall of 260TWh/year. In this context, although the EU held only 20% of the world wind energy generation in the early 90s (Fig. 2b), production of European wind parks managed to even reach 70% in the years after 2000, with a production of 100TWh/year already achieved by the end of 2007.

Integrated wind-solar power generation with battery storage forms a complementary system because of the fact that wind is more dynamic source for providing energy during periods of little or no sunshine; the battery storage allows for the displacement of the energy by storing at a favorable time and then using this excess energy when required. This complementary feature is favorable for system reliability. [katti]

In the paper presented M. khatebi and M. jazeri presented that a great amount of the energy which is generated by renewable energy-based generation units, such as wind farms, is often rejected because of the network restrictions. Moreover, most of renewable energy sources, such as wind and solar are uncertain and uncontrollable at times so there is need to overcome these problems. In order to overcome these drawbacks, the rejected energy can be applied to pumped storage power plants and can be reutilized via hydro-turbines whenever needed. Optimal sizing of such power plants is crucial in enhancing the recovery of the rejected energy. [M. khatebi]

Pumped storage units are nothing but just a type of hydroelectric power generation used by some power plants for load balancing. Pumped-hydro storage is the oldest and largest of all of the commercially available energy storage technologies.

The most advanced setup that has been observed till now is the integration of solar wind diesel forms of energy which together creates a mixed hybrid. Among the different combination of resources, solar photovoltaic (PV) and wind energy resource combination along with either some energy storage system or with diesel generator (DG) system has been explicitly explored by the researchers. Rajendra Prasad and Natarajan considered photovoltaic (PV) and wind energy resources with battery storage. Similarly, Yang *et al.* considered a hybrid PV-wind system with battery storage and presented a novel optimization sizing model.

In this paper, an optimization problem has been formulated to identify the optimum daily operational strategy for a hybrid solar-wind system. the income from the power sold to the electricity market has been maximized for the optimum daily scheduling, while the expenses made towards the operation of wind-solar have been minimized. Various operational constraints have also been taken into account to formulate the scheduling problem. The formulated problem has been solved using Linear Programming technique.

The optimal daily scheduling approach presented in the paper

can prove to be a very useful approach for deciding the operational strategy of stand-alone wind-solar-diesel systems. Besides, the usefulness of this approach, it includes maximization of the profit also for an independent power producer by calculating the optimal daily scheduling of their wind-solar-diesel system with battery storage facilities. [mohitbansal]

In the paper presented by N.M.ijumb evaluation of the Different renewable energy sources and their suitability to supply a group of loads in a rural area is presented. A computer program with various subroutines has been developed to match the characteristics of renewable energy sources with rural loads profiles, cost effectively.

Both unitary and hybrid systems have been considered. The integrated load profile of the study area shows that predominant morning (7am, 100kW) and evening (7pm, 150kW) are the peaks (Figure 1) and The peak demand periods occur only when solar and wind energy sources have either low or no outputs. Therefore, it is necessary to take into account the energy storage requirements when such systems are being used. The capacity of the required battery bank was on the basis of one day of supply, in case of inadequate wind speeds or low insolation levels. In the case of the solar system, the cost of the battery bank was about 3-6% of the total system capital costs. The corresponding figures for the wind energy system were 47-69%.

Out Of the three stand-alone systems that have been considered, the solar system considered as the most expensive one. If the wind speeds are recorded in the area, it was found to be more economical to supply the load using 2x 170kW or 250kW wind turbine. The capital cost of the system comes out between R20kW and R50kW. A solar system of the same capacity would be more than 10 times as much. The average flow rate of the river flowing in the study area, measured over a nine year period, was 12.7 cubic meters per second, for the January to March period and 3.1 cubic meters per second for the July to September period. [nm ijumba]

In the paper presented by Sumedha Rajakaruna a new concept of solar energy that is green electric energy park has been discussed. Green Electric Energy Park at Curtin University is a laboratory where renewable energy systems integration will be done.. It has been designed in such a way that the characteristics of every possible renewable energy sources such as solar photovoltaic arrays, micro hydro turbines or wind turbines and fuel cell stacks can be measured digitally, displayed and analyzed on workstation computers and central displays even when they are supplying power to isolated dc or ac loads, even at the time of charging batteries, and even when they are connected to the main grid or are operating as an isolated micro-grid. Other system variables such as current and voltage at all the nodes are measured and Weather conditions are studied and are made available through the local area network over the internet to students for analyzing the data at the laboratory and is also displayed graphically in lecture theatres as well. All the feeds from renewable energy sources and network operating conditions will be made available to research stations where new ways of combining, controlling and converting renewable energy sources will be experimented. [rajakurna]

The paper has examined the STATCOM hysteresis control

technique for harmonic cancelation with load tracking in a system where a wind turbine is present and it examined the work of the SVPWM operated DVR when connected to a critical load from the same system. It used a separate control for the STATCOM and the DVR interchanging their roles. This gives room to the subject of combining the two without having overlapping problems. This paper used as non-linear loads simple AC to DC rectifiers, another subject to be examined in the future is changing the non-linear load type. [Walid Frangieh].

In the paper described by gupta a hybrid system was designed comprising solar photovoltaic wind and biomass was used to supply continues energy to load. A diesel generator was further provided to supply continues energy.

In the second decade of 21st century there are still too many households without electricity supply in Bosnia and Herzegovina. They are situated in remote, sparsely populated, rural areas where distribution power lines were completely destroyed during the last war. The restoration requires large investments in power grid extension. The decreasing price of renewable energy installations and significant solar, wind and hydro energy potential in Bosnia and Herzegovina make a renewable energy based micro power system (MPS) worth considering as a feasible and cost-effective alternative. Optimal design of such system depends on several factors such as renewable energy sources (RES) potential for a specific site, load requirements, the required level of reliability, fuel price, etc. The paper investigates application possibilities of RES based MPS for rural electrification in Bosnia and Herzegovina. Four representative rural sites in different geographical and climatic regions were chosen to simulate load requirements and system production, based on a one year input data. Comparative analysis of wind and solar resources potential for each site is given as an input to the feasibility assessment of the MPS. The optimal design of MPS is proposed based on an energy production analysis and financial viability analysis for each site under investigation. A sensitivity analysis is conducted in order to determine how system parameters and total cost may change if the system is designed with different reliability criteria.

HOMER software was used for design and optimization of MPS for each site under investigation. Optimal solution is considered to be the configuration with lowest net present cost (NPC) which satisfies maximum annual capacity shortage constraint of 5%. Proposed MPS in each site includes PV component and batteries, but size and number of units varies from site to site, in dependence of available resources. The most cost-effective MPS configuration is in southern B&H, what corresponds with the fact that this part of country has the highest solar and wind potential. Although, wind potential is very high, optimal configuration doesn't include wind turbine. Second most cost-effective MPS is in eastern B&H, with only 2 % higher NPC. It also includes wind turbine.

Central and northwestern part of B&H (Djakovici and Prkosi site) have the lowest wind and solar potential, and consequently optimal configurations for these sites are more expensive compared to Ravno site.

## Conclusion

This paper conclude that there is a huge scope in the field of

hybrid energy. This is the only scope of future energies. This can fill the gap of shortage of energy. So that future generation can get a renewable source of energy.

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