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A Review Article of Higher Efficiency Solar and Thermal Hybrid Power Plant Based on Pi Controller

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***Abstract* – Now a day's electricity is most needed facility for the human being. All the conventional energy resources are depleting day by day. So we have to shift from conventional to non-conventional energy resources. In this the combination of two energy resources is takes place i.e. PTC, wind and thermal energy. This process reviles the sustainable energy resources without damaging the nature. We can give uninterrupted power by using hybrid energy system. Basically this system involves the integration of two energy system that will give continuous power. Solar panels are used for converting solar energy and wind turbines are used for converting wind energy into electricity. This electrical power can utilize for various purpose. Generation of electricity will be takes place at affordable cost. This work deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance.**

***Keywords*– Hybrid, PTC, power, wind, Thermal.**

I. INTRODUCTION

AS well known the main resources of energy in Libya are oil and gas which results in high emission of carbon dioxide and other gases. As the modern world consistently emphasizes on using renewable energy to generate electricity, which is harmless to the environment. Hybrid power plant is a new developed technology that is used to convert solar energy with any system that generates energy[1][2].

Parabolic trough solar power plants are the most proven system of concentrating solar power (CSP) techniques [3][4][5]. There are nine parabolic troughs solar electricity generating system (SEGS) in California, USA illustrates the capability of this technology to be a reliable, renewable energy resource. This system has been operating commercially as large-scale thermal solar power plants with a total output of 345 MW [4].

CSP plants are promising technologies to be the alternative clean energy resource to meet the increasing energy demand and thus reduce the environmental impact. Electricity produced by CSP in the Mediterranean and North African (MENA) region can be used to improve the local energy production systems and can be exported to the EU. It aims at interconnecting the electricity grids of the Mediterranean, North Africa regions Europe, generating power by employing CSP in MENA and exporting it to the EU using a high voltage direct current HVDC network. The goal is to export about 700 TWh/year to the EU. Ensuring energy security, energy resources used in the country in the future need to be diversified.

Also to ensure the continuity of supply, energy mix need to be rationalized considering important factors, such as economic cost, environmental impact, reliability of supplies and convenience to consumers. The hybrid renewable power generation is a system aimed at the production and utilization of the electrical energy stemming from more than one source, provided that at least one of them is renewable.

Through this project it is expected to give concern about development of the wind-solar hybrid power generation systems where wind solar potential is high in Libya. Under this project, solar energy and wind energy potentials are going to be investigated at geographically location in Libya by collecting data from different sources. Then selected location is going to be analyzed using a software tool. The HOMER (Hybrid Optimization Model for Electric Renewable). The software is a micropower optimization model for both off-grid and grid connected power systems in a variety of applications.

Wind-solar hybrid system has numerous advantages. One of the advantages is reliability, when solar and wind power production resources are used together, reliability is improved and the system energy service is enhanced. What this mean is that in the absence of one type of energy, another would be available to carry out the service. Other advantages are the stability and lower maintenance requirements, thus reducing downtime during repairs or routine maintenance. In addition to

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these, as well as being indigenous and free, renewable energy resources contribute to the reduction of pollution emissions.

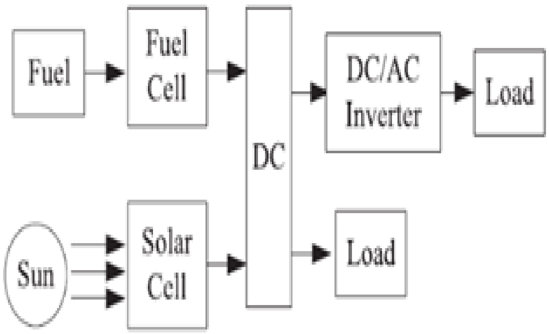

Fig.1.Distributed combination of solar cells and fuel cells system.

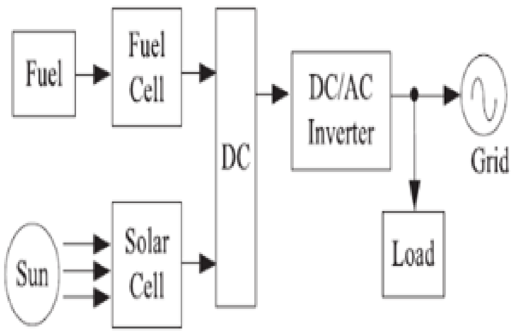

Fig.2. Grid-connected combination of solar cells and fuel cells system.

II.PROJECT OBJECTIVE

1. Hybrid solar–wind and battery power plant

Idea and realisation of the plant The team from Warsaw University of Technology, Group of Electric Power Plants and Power Engineering Economy has built a hybrid solar and wind power plant .

Fig. 3. View of solar panels and wind turbine of the hybrid power plant.

That was as a response to a request from a Polish telecommunications company. This hybrid power plant has supplied the telephone exchange. The company wanted to have a clean energy source – something what could replace diesel generators, particularly in installations placed far from the public grid. The power plant had to produce energy all of the time without any breaks. Fig.2.1 shows a general view and Fig.2.1 shows a block diagram of the hybrid power plant.

2. Some problems caused by uncontrolled power sources

As a result of research we observed a number of problems connected to uncontrolled power production and co-operation with the power grid. We consider the most significant problems to be: - the rapid and unpredictable changes in electricity production, - the sudden disappearances of power generation, - the poor usage of primary energy carriers. It has to be stressed that time constants of the phenomena are much smaller than in classical power plants.

The uncontrolled sources' power production depends mainly on sun irradiation and wind speed. The power versus time curve, called the production profile, follows the primary energy carrier availability versus time curve. In fact, the changes are extremely rapid (Fig.2.2). In the case when many similar power plants are installed, source power changes result in the need to increase the hot capacity reserve in the power grid.

The reserve has to be capable to cover load demand in case electricity production from wind or sunshine fall. The additional reserve is necessary in grids with relatively high capacity in power sources like wind turbines. The sudden disappearance of power production was observed in the power plant. In the aftermath of that, it could be a large power shortage in the power grid. The shortage has to be immediately replaced by other sources.

The problem is that turbine sets or diesel sets cannot be speeded up enough quickly and the problem could not be solved by increasing the hot reserve. The reason is the poor dynamics of turbine sets. Thus, other methods have to be applied. One such method could be to apply an energy storage system or a new, fast enough, controlled power source.

It is almost impossible to produce power simultaneously from both renewable sources in plant shown in Fig. 2.2 .This is due to the nature of the DC link. The power converters (DC/DC, AC/DC1 and AC/DC2) had diodes in the output circuit. Those diodes were necessary to protect the sources (especially solar panels) from opposite polarization (mostly the diodes are structural part of converters). So there were two parallel connected diodes in renewable sources connection.

In consequence only one from two sources could supply the load at the same time. If the sun has given e.g. 50% of load needs and wind 40%, it was necessary to supply the load from chemical battery although the sources together could produce enough power to meet needs. But neither of them could supply the load alone.

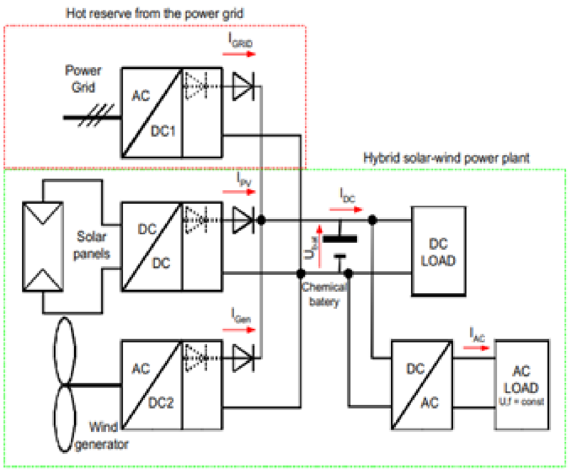

Fig.4. Block diagram of the hybrid solar–wind and battery power plant.

3. Shading and dirt

Photovoltaic cell electrical output is extremely sensitive to shading.[46][47][48] When even a small portion of a cell, module, or array is shaded, with the remainder is in sunlight, the output falls dramatically due to internal 'short-circuiting' (the electrons reversing course through the shaded portion of the p-n junction). If the current drawn from the series string of cells is no greater than the current that can be produced by the shaded cell, the current (and so power) developed by the string is limited.

If enough voltage is available from the other cells in a string, current will be forced through the cell by breaking down the junction in the shaded portion. This breakdown voltage in common cells is between 10 and 30 volts. Instead of adding to the power produced by the panel, the shaded cell absorbs power, turning it into heat. Since the reverse voltage of a shaded cell is much greater than the forward voltage of an illuminated cell, one shaded cell can absorb the power of many other cells in the string, disproportionately affecting panel output. For example, a shaded cell may drop 8 volts, instead of adding 0.5 volts, at a particular current level, thereby absorbing the power produced by 16 other cells.[49] It is thus important that a PV installation is not shaded by trees or other obstructions.

Several methods have been developed to determine shading losses from trees to PV systems over both large regions using LiDAR,but also at an individual system level using sketchup.Most modules have bypass diodes between each cell or string of cells that minimize the effects of shading and only lose the power of the shaded portion of the array. The main job of the bypass diode is to eliminate hot spots that form on cells that can cause further damage to the array, and cause fires. Sunlight can be absorbed by dust, snow, or other impurities at the surface of the module. This can reduce the light that strikes the cells. In general these losses aggregated over the year are small even for locations in Canada.Maintaining a clean module surface will increase output performance over the life of the module. Google found that cleaning flat mounted solar panels after 15 months increased their output by almost 100%, but that 5% tilted arrays were adequately cleaned by rainwater[5-11].

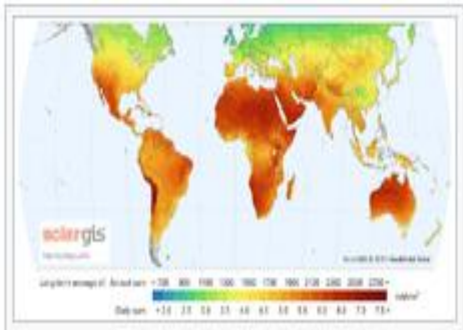

Fig.5. gobalsolar.

III. LITERATURE REVIEW

Jo´ zefPaska*, PiotrBiczel, Mariusz K1os "Hybrid power systems – An effective way of utilising primary energy sources" Nowadays in many countries the increase of generating capacity takes place in small units within the framework of so-called distributed power industry (distributed generation – DG, embedded generation), and among them in hybrid power systems (HPS). In this paper we present our experience of the design, build and exploitation of HPS in the Institute of Electrical Power Engineering, Warsaw University of Technology. The following major subjects are considered.

Karim Mousa , HamzahAlZu'bi , Ali Diabat"Design of a Hybrid Solar-Wind Power Plant Using Optimization" (2014)Although solar and wind energy are two of the most viable renewable energy sources, little research has been done on operating both energy sources alongside one another in order to take advantage of their complementary characters. In this paper, we develop an optimal design for a hybrid solar-wind energy plant, where the variables that are optimized over include the number of photovoltaic modules, the wind turbine height, the number of wind turbines, and the turbine rotor diameter, and the goal is to minimize costs. Simulation studies and sensitivity analysis reveal that the hybrid plant is able to exploit the complementary nature of the two energy sources, and deliver energy reliably throughout the year.

G.J.NathanabM.JafarianabB.B.DallyabW.L.SawacP.J.AshmanacE.HuabA.Steinfeld" Solar thermal hybrids for combustion power plant: A growing opportunity" The development of technologies to hybridise concentrating solar thermal energy (CST) and combustion technologies, is driven by the potential to provide both cost-effective CO2 mitigation and firm supply. Hybridisation, which involves combining the two energy sources within a single plant, offers these benefits over the stand-alone counterparts through the use of shared infrastructure and increased efficiency. In the near-term, hybrids between solar and fossil fuelled systems without carbon capture offer potential to lower the use of fossil fuels,

while in the longer term they offer potential for low-cost carbon-neutral or carbon-negative energy. The integration of CST into CO2 capture technologies such as oxy-fuel combustion and chemical looping combustion is potentially attractive because the same components can be used for both CO2 capture and the storage of solar energy, to reduce total infrastructure and cost. The use of these hybrids with biomass and/or renewable fuels, offers the additional potential for carbon-negative energy with relatively low cost. In addition to reviewing these technologies, we propose a methodology for classifying solar-combustion hybrid technologies and assess the progress and challenges of each. Particular attention is paid to "direct hybrids", which harness the two energy sources in a common solar receiver or reactor to reduce total infrastructure and losses.

RaghavendraP P, MahadeviBiradarP "Hybrid Power Generation System using Solar and Peltier Plate" (2016)Nowadays, there is a demand to increase the power generation capacity because of steadily rising electrical energy consumption. In order to achieve this, renewable energy sources are the best option. However, the reserves of fossil fuels will soon be depleted, since oil is a limited resource. So overcome this we can use the renewable energy sources as it will also provide a cleaner environment for future generations. Renewable energy can be created by many methods; for example, solar energy, wind energy, hydro energy, nuclear energy, and many more. For each of these different forms of creating electricity, there are certain limitations. Among all the renewable energy sources, solar power generation system tops the list. But solar energy can only be created when there is sunlight, so overcome this by we can hybrid with other technologies, so here using hybrid generation using the solar and peltier plate. So when there is no sun then we can be get generate energy using the peltier plate. The solar and peltier energy obtained is stored to a battery. By hybrid which increases cell life, improve performance, and provide operational benefits under different environmental conditions. The battery which is used can be recharged with the two generation inputs like solar and peltier. The battery is connected to the inverter. From this energy the ac motor can be controlled using inverter design.

Jorge F. Servert, Diego López, Eduardo Cerrajero, Alberto R. Rocha , Daniel Pereira Lucía Gonzalez "Solar Hybrid Power Plants: Solar Energy Contribution in Reaching Full Dispatchability and Firmness"(2015) Renewable energies for electricity generation have always been considered as a risk for the electricity system due to its lack of dispatchability and firmness. Renewable energies penetration is constrained to strong grids or else its production must be limited to ensure grid stability, which is kept by the usage of hydropower energy or fossil-fueled power plants. CSP technology has an opportunity to arise not only as a dispatchable and firm technology, but also as an alternative that improves grid stability. To achieve that objective, solar hybrid configurations are being developed, being the most representative three different solutions: SAPG, ISCC and HYSOL. A reference scenario in Kingdom of Saudi Arabia (KSA) has been defined to compare these solutions, which have been modelled, simulated and evaluated in terms of dispatchability and firmness using ratios defined by the authors. The results show that: a) SAPG obtains the highest firmness KPI values, but no operation constraints have been considered for the coal boiler and the solar energy contribution is limited to 1.7%, b) ISCC provides dispatchable and firm electricity production but its solar energy contribution is limited to a 6.4%, and c) HYSOL presents the higher solar energy contribution of all the technologies considered: 66.0% while providing dispatchable and firm generation in similar conditions as SAPG and ISCC.

IV. CONCLUSION

A parabolic trough is a type of PTC thermal collector that is straight in one dimension and curved as a parabola in the other two, lined with a polished metal mirror. The sunlight which enters the mirror parallel to its plane of symmetry is focused along the focal line, where objects are positioned that is intended to be heated. In a PTC cooker, for example, food is placed at the focal line of a trough, which is cooked when the trough is aimed so the Sun is in its plane of symmetry [5-10].

For other purposes, a tube containing a fluid runs the length of the trough at its focal line. The sunlight is concentrated on the tube and the fluid heated to a high temperature by the energy of the sunlight. The hot fluid can be piped to a heat engine, which uses the heat energy to drive machinery, or to generate electricity. This PTC energy collector is the most common and best known type of parabolic trough .When heat transfer fluid is used to heat steam to drive a standard turbine generator, thermal efficiency ranges from 60-80%.Large-scale PTC thermal power plants need a method for storing the energy, such as a thermocline tank, which uses a mixture of silica sand and quartzite rock to displace a significant portion of the volume in the tank. It is then filled with the heat tran Parabolic Troughs (PTs) are a class of PTC concentrators that are curved as a parabola and placed in a straight line.

The collector used in this PTC thermal plant consists of parabolic reflectors (a series of mirrors), a metallic structure, a PTC tracking system, and receiver tube. This type of parabolic trough PTC collectors may have a concentration ratio of about 80%. The mirror is made of borosilicate glass, whose transmittance is approximately 98%. This glass is covered with a layer of silver in its lower part, with a special coating and protection. The best reflector can reflect 97% of incident radiation. The role of the PTC tracking mechanism is adapted to maintain the incident PTC radiation perpendicular to the reflector. The radiation is reflected to the focal line of the parabola where a receiver tube contains the heat transfer fluid. The tube receiver or heat collection element (HCE) is of Schott PTR 70 type. It is composed of two concentric tubes. The stainless-steel absorber tube, surrounded by a partially evacuated glass envelope to minimize heat losses result. The receiver tube contains a heat transfer fluid which is a synthetic oil (Therminol VP-1)[11].

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