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Hybrid Power Generation

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Abstract- **Fast depletion of fossil fuels and serious pollution hazards occuring due their burning have forced us to look for the nonconventional power generation systems .Solar/wind/biomass power generating system which are based on non-conventional and renewable sources are being widely used in many parts of the world. Though these power generating systems besides being eco-friendly posses few other positive aspects , they have some or the other drawbacks, like Solar panels are too much costly and the production cost of power by using them is generally higher than the conventional process, it also not available in the night/in cloudy days, similarly Wind turbines can't operate in high or low wind speeds, Biomass plant collapses in low temperature and a geothermal power plant produces less power if the temperature of geothermal brine is low (say<120 degree celsius). In this technical paper we have designed a methodology of completely eliminating the above mentioned drawbacks by combining all four power generating systems into one single hybrid.**

1 INTRODUCTION

While fossil fuels will be the main fuels for thermal power , there is a fear that they will get exhausted eventually in the next century. Therefore other systems based in nonconventional and renewable sources are being tried by many countries . These are : solar energy, wind energy, geothermal energy, biomass energy etc. Four of them are briefly discussed below.

1) Solar energy **:** Solar energy refers to the energy in the form of light and heat, obtained from the sun. It is a valuable source of renewable energy on earth. The Earth receives about 174 petawatts (1.74×10^{17} W) of incoming solar radiation at the top layers of the atmosphere. About 30% of it is reflected back to space while the remaining 70% is absorbed by clouds, oceans and land masses. Every day, the sun shines down on our earth. Its rays provide us solar energy, which is useful in many ways. The solar energy showered by the sun, in the form of rays is commonly known as **solar radiation**, and contains a significant amount of energy we are able to harness.
2) Wind energy : Wind energy uses the high wind velocity available in certain parts . It is induced chiefly by the uneven heating of the earth's crust by the sun . wind energy is used for pumping the water or power generation. A minimum wind speed of 3 m/s is needed.This is considered to have a high efficiency.

3) Geothermal energy : Geothermal energy derives its heat in the centre of the earth and its is stated that potential to the extent of 3400 MW exists in New Zealand , USA, Japan and Iceland. Geothermal energy can also be used for cooling by using heat for vapour absorption system.

4) Biomass energy: Biomass is another renewable source of energy in the form of wood, agricultural residues, etc. Biomass can be burnt directly to generate steam for use in steam turbine for power generation or they can be gasified and the gas used in an IC Engine for agricultural pumping or power generation.

2 METHODLOGY

As mentioned earlier ,if all the four are combined into one hybrid power generating system the drawbacks can be avoided partially/completely, depending on the control units. As the one or more drawbacks can be overcome by the other, as in northern hemisphere it is generally seen that in windy days the solar power is limited and vice versa and in summer and rainy season the biomass plant can operate in a full flagged so the power generation can be maintained in the above stated condition. The cost of solar panel can be subsided by using flat plate solar collector .The hot water at about 100 degree celsius is stored in a well insulated tank. From here , it flow as through a heat exchanger through which the working fluid of low boiling point temperature (isobutane—10 degree celsius at 1 atm) is also passed .Consequently its vapour are formed which are directed towards the turbine to move the prime mover.

Now the question arises what about the winter nights or cloudy winter days with very low wind speeds. Here comes the activity of the Hydrogen. As we know the process of electrolysis can produce hydrogen by breaking water into

hydrogen and oxygen, it can be stored; hydrogen is also a good fuel and burns with oxygen to give water. Hydrogen can be used to maintain the temperature of the biomass reservoir in winter so that it can produce biogas in optimum amount for the power generation. As stated above biogas is a good source in summer; in this period the solar energy available is also at its peak, so if the demand and supply is properly checked and calculated the excess energy can be used in the production of hydrogen and can be stored. Stored hydrogen can be either used as a fuel or direct space heating or industrial process heat , or even if required it can be reconverted into electricity. In sunny, windy &hot day, the turbine operates with full speed as the supply is maximum, and this excess power can be consumed for the process of manufacturing hydrogen. In winter, the power consumption is also low so the supply limit is low, and obtained with lesser consumption.

In many parts of the world like in germany , the temperature of geothermal brine that can be tapped in natural reservoirs generally stays below 120 degree celsius . The production of electricity is economically not feasible in most of these areas , because with low temperatures degree of efficiency and thus the amount of produced power is small. Here, biomass plant comes to play its role. In a fermentation process ,taking place inside a biomass plant, methane is produced and then it is combusted inside a gas engine and .These engine drive a generator. With the help of a heat exchanger , the heat of cooling systems and the heat coming out of the engine is fed into the power producing cycle of the geothermal power plant. If the temperature of the geothermal cycle amounts to say 105 degree celsius , the cycle can be heated up to 120 degree celsius, depending on the biomass plant size. If the water (underground brine) is boiled by the geothermal source to 100 degree celsius then it can be later very easily superheated to 200 degree celsius by the heat as obtained from the gas engine. Notice that the high pressure of the system in this case will be at 100kpa allowing a conveinent de-areator to be placed at pump outlet.

III. Regulating the power output

The output from the renewables , if excess is amount , is used to carry out the production of hydrogen and oxygen by electolysis. After this it may be connected to a rechargeable battery bank followed by the load. If the load is an alternating current then either a three phase rectifier or an inverter can be used so as to convert the direct current into alternating current.Consideration about voltage transition among modules starting from wind generator,battery charger controller, inverter or rectifier should be subject to voltage standards which mainly focus about voltage compatibility.

4 LIMITATIONS

(A) Accurately the output cannot be measured
(B) Performance is yet is to be improved a lot
(C) Not portable due to its bulkiness
(D) Limited to areas near the equatorial regions
(E) Infrastructure cost may be high

5 CONCLUSION

In this present scenario in which we are encountering a terrible situation of fast depleting conventional energy resources , Hybrid renewable energy systems have proved to be as a one most the most promising power production systems . HRES being eco friendly have gained much popularity for remote area power generation applications due to advances in renewable energy technologies subsequent rise in prices of petroleum products.

6 REFERENCES

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SCHEMATIC OF A HYBRID POWER GENERATION SYSTEM