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Technological Peripheral of Geosolar Hybrid Cooling System

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ABSTRACT

Earth's interior generates surface phenomena such as lava flows, fumaroles, hot springs, geysers .The heat that comes from subsurface of the earth's molten Interior consists of magma heats from nearby rock and underground aquifers, is called Geothermal energy. It is one of the most sustainable, carbon free and renewable form of energy as stated by The British Geological Survey. The enormousness of the Geothermal energy can be known by the considerable amount of production of approximately 8.3% of total world electricity with geothermal energy, supplying up to 17% of world's population. India being an enormous Country has a vast potential to become leading contributor in generating eco-friendly and cost-effective geothermal energy. The GSI (Geological Survey of India) has identified 350 geothermal energy locations in the country. The estimated potential for geothermal energy in India is about 10000 MW. This study will help us to reveal the feasibility of hybrid cooling system in accelerating the growth of opportunities to know the real potential of number of hybrid cooling system which have been modelled and also help us in analysing the typical pros and cons of large-scale geothermal power plants. This study will also help us to deeply investigate Idea of hybrid cooling system in Emerging geothermal plants in India.

1. INTRODUCTION

This paper intends to make a critical analysis of the various aspects of hybrid geothermal energy. As the hybrid approach may enable utilization of geothermal energy in various parameters combining different cooling processes and help us investigate the consumption and performance of hybrid cooling systems. The hybrid cooling system significantly offers a significant reduction in energy consumption and a coefficient of performance; thus, enhancement varies according to different system designs and climatic conditions. Hybrid cooling systems composes of different components as hybrid cooling combines dry and evaporation cooling to provide heat rejection and different aspects like energy consumption and reducing water intake. This paper provides a detailed review of existing hybrid cooling system. Thus, on the basis of theoretical approach enabling various parameters outperforming individuals such as stand-alone geothermal and waste heat power plants, where generally moderate geothermal enrichment is primarily available. Thus, such hybrid power plants are more economically beneficial than separate power plants (Sircar et al., 2017; Shah et al., 2019., Shah et al., 2020).

According to the combination of cooling process the hybrid cooling system can be classified in five main categories-

- Desiccant evaporative
- Absorption based cooling
- Multi evaporator cooling
- Adsorption based cooling
- Vapour compression-based cooling

Hybrid cooling generally refers to use of water in addition to air for plant heat load rejection. Hybrid cooling can be achieved in various methods. But we can investigate two main methods,

1. Wetted media
2. Hybrid acc
3. Hybird heller

2. WETTED MEDIA

In wetted media one of the most preferred methods used to improve the performance of the evaporative cooling structures as to intake the cooler air by evaporating water in the air flow. This method generally works perfectly when the air is predominantly dry. When intake air enters the contact area that is supposed to be humidified and cooled. To reduce the bio fouling and clogging of the packing a blowdown is necessary to maintain the water within acceptable levels of dissolved solids content. The when wetted media procedure is used the air can approach the wet bulb temperature with a maximum effectiveness of around 80%. Spray and fogging system can also be used to saturate the inlet air which could help in cooling completely the air down to its wet bulb temperature.

3 WET COLLER WITH DRY TRIM

This type of units are capable of running a wet and dry mode simultaneously buy by using the method of separate section above the coil. This unit is capable of running dry mode and also 50% of the unit in wet mode, providing the capacity needed for the entire unit resulting in a significant drop of water consumption which is very beneficial compared to evaporation cooling units. It has been created for procuring the ideal solution for or getting a desired reduction of energy consumption and water consumption. The technological development is based primarily on sustainable product which could in for the future eliminate the usage of harmful Chemicals from the environment and reduce greenhouse gases, save water and reduce maximum sound emission.

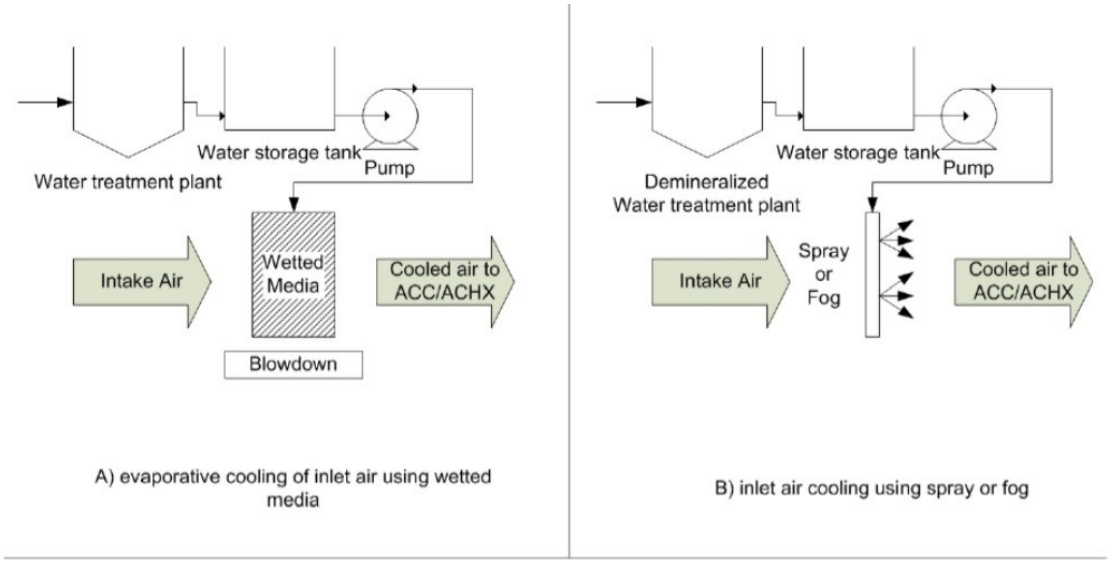


Figure 1 Wet Cooler Schematic

4 HYBRID ADVANCED COMBUSTION CONTROL

This is an advanced combustion control system which helps us achieve the complete burning of an unburned gas such as CO in low air ratio operation, and helps vastly in stabilization of evaporation amount. The arrangement of this system allows the advanced combustion control system to reject a smaller load and hence operate at a lower internal temperature difference providing the possibility of increase of the system performance. Generally, a fraction of the turbine exhaust in diverted towards the surface condenser. Analyzed data shows that a certain amount of water-cooled portion necessarily rejects 30% of the total condenser load.

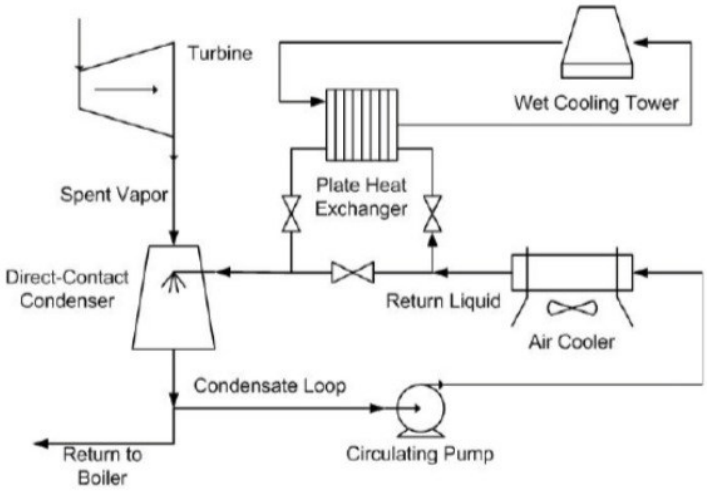
5 DRY COOLER WITH WET TRIM

This method uses the dry cooler with wet trim providing the dry cooling coil persistent part of the cooling system also pressurized water distribution system are capable of handling a major portion of unit's cooling capacity. When the process is going on the dry coil to wet coil placed exactly below the pressurized water distribution system. The major advantage of using this kind of system is it provides a significantly higher driver switchover temperature which prominently enables the unit to run entirely dry for the majority of the time (Ashwood and Bharathan, 2011).

6 HYBRID HELLER

This system uses an auxiliary belt cooled heat exchanger. This power plant waste heat is generally exchanged in a condenser by using a closed cooling water circuit. At Lower ambient temperature the dry and wet combination is well established even when the same vacuum is utilized that was used for wet cooling as due to increase pressure loss of increasing volumetric steam flow can be observed (Raffic et al., 2016). The most adaptable and complementary features of an heller system are-

- It supports power cycle operational flexibility.
- Incorporate the cost efficiently and are environmentally compatible
- The annual average efficiency gap provides highest efficiency among dry cooling options.
- Chemistry for power cycle water
- Offers a massive present value cost reduction over direct ACC.



. Schematic of the hybrid Heller system (wet-cooled heat exchanger in series with ACHX)

Figure 2 Hybrid Heller System

7 CHALLENGES

It is found each hybrid system combines the advantage of different cooling process. Numerous hybrid System combining different cooling processes had helped us reduce the energy consumption, but along with it comes various control system having a complex architecture which are used for monitoring and controlling purposes. Managing a vast system requires determine controller with a knowledge of algorithm that enables a person to analyses the driving design complexity system and mature control systems utilizing brakes and engines, transmission, etc (Shah et al., 2019).

Certain standardized of hybrid components is quite difficult to assist noncompetitive areas such as connectors, interlocks, power ratings and battery test methods (Shah et al., 2020). Hybrid cooling system do possess complex models thus numerous challenges can be encountered such as-

1. Climatic conditions such as moisture, air, dust, vibrations and temperature variations ranging from -40°C to 125°C, hinders operating conditions making it difficult to withstand harsh environmental aspects.

2. Hybrid cooling systems may include electronic content,

having a complex system design, also requiring an advanced technological understanding of subsystems interaction and algorithmic knowledge of development of various robust control strategies applied in intellectual hybrid cooling system.

3. Electromagnet magnetic compatibilities such as motors, inverters and controllers are supposed to be shielded to ensure low emissions.

4. To ensure profitability engineers are still searching for ways to get rid of cost increasing measures, attempting to implement modular production that drastically reduce assembly costs.

5. Hybrid cooling system should be fault tolerant and redundant.

8. CONCLUSION

Hybrid cooling system gives minimum energy consumption and provides the most promising cooling solution that are very beneficial for making a comprehensive evaluation based on an intellectual economic cycle utilizing the present value and cost analysis. In this study we looked upon different heat rejection load from different power plants approaches. We also evaluated dry and wet assist systems, that helped us evaluate the heat exchanger, hybrid Acc, generally the tower and water steams are sized to handle about 30% of the heat rejection load from the plant, whereas only 70% of the load is carried by air cooled heat rejection systems. Hybrid cooling system has been considered one of the most important factors for growth of the world economy, which has seen increase in energy consumption bringing consequent growth and searches for new sources of energy.

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