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Energy Saving of Cooling Tower by Using PLC Automation

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ABSTRACT

A cooling tower is a heat rejection device that rejects waste heat to the atmosphere through the cooling of a water stream to a lower temperature. Cooling towers may either use the evaporation of water to remove process heat and cool the working fluid to near the wet-bulb air temperature or, in the case of closed circuit dry cooling towers, rely solely on air to cool the working fluid to near the dry-bulb air temperature. Common applications include cooling the circulating water used in oil refineries, petrochemical and other chemical plants, thermal power stations and HVAC systems for cooling buildings. The classification is based on the type of air induction into the tower: the main types of cooling towers are natural draft and induced draft cooling towers

Keywords: PLC, Energy Saving , Cooling Tower, Thermal power station

I. INTRODUCTION

Cooling towers are a very important part of many plants. The primary task of a cooling tower is to reject heat into the atmosphere. They represent a relatively inexpensive anddependable means of removing low-grade heat from cooling water. The make-up water sourceis used to replenish water lost to evaporation. Hot water from heat exchangers is sent to thecooling tower. The water exits the cooling tower and is sent back to the exchangers or to otherunits for further cooling.

The Cooling water facility in a Process industry offers great scope for energy efficient operation by way of selective switching and speed control of various equipments. As the power consumption of pumps and fans is directly proportional to cube of speed, a reduction in speed, based on quality and quantity of cooling water required, results in saving of huge quantum of energy.

Incorporation of a Programmable Logic Controller (PLC) for automation of operation of plant is also aimed in this project. Switching of Cooling water pumps and fans, based on requirement can also be achieved by incorporation of PLC. Another attempt is also made to save the energy by connecting power factor improving capacitor as using this the customer can get power with good voltage regulation and can also reduce the electricity bill. Here PLC is used as maintenance is and operator canchange the program as per his requirement. The analysis has been done as per the data in FACT in Udyogamandal, where the cooling water facility is examined from the energy conservation angle. Cooling towers vary in size from small roof-top units to very large hyperboloid structures (as in the adjacent image) that can be up to 200 metres (660 ft)

tall and 100 metres (330 ft) in diameter, or rectangular structures that can be over 40 metres (130 ft) tall and 80 metres (260 ft) long. The hyperboloid cooling towers are often associated with nuclear power plants although they are also used in some coal-fired plants and to some extent in some large chemical and other industrial plants. Although these large towers are very prominent, the vast majority of cooling towers are much smaller, including many units installed on or near buildings to discharge heat from air conditioning.

II. LITERATURE SURVEY

Natural draft cooling tower neeteshsingh raghuvanshi, dr. aloksingh[1] (2014) Cooling tower closing maintenance is extremely complicated and time intense. This drawback is happens once correct sequencing procedure isn't employed in closing maintenance. Closing maintenance of cooling system is happens once the part of cooling system aren't activity their functions properly causes the performance of cooling system reduces. Once we use the correct sequence of closing maintenance activity then we are able to cut back the quality in maintenance activity and reach the less time with minimum labor. Once these maintenance activities square measure unplanned then it will increase the overhauling value of a cooling system in terms of labor value and time consumption.

Xiaoxiao Li, Hal Gurgenci, Zhiqiang Guan, Yubiao Sun[2] The heat rejection rate of natural draft dry cooling system, furthermore because the in operation performance of an influence plant, will be full of varied close factors. The cold flow is unfavorable air turbulence at the highest of the cooling system and includes an important negative impact on the performance of natural draft cooling towers. Within the gift analysis, results square measure given for a 20m high natural draft dry cooling system experimental system tested at totally different close conditions. Measurements of crosswind influence on a natural draft dry cooling tower for a solar thermal power plant by

Xiaoxiao Li, Hal Gurgenci, Zhiqiang Guan, Yubiao Sun[3] International Journal of Pure and Applied Mathematics Special Issue 2747 Crosswind could be an important concern for natural draft dry cooling towers. The priority is a lot of serious for shorter towers. Therefore, the current of air influence could be an important threat to the utilization of natural draft dry cooling towers in concentrating star thermal power plants, that square measure typically engineered at sizes smaller than typical fossil-fired plants and use comparatively shorter towers.

ZhengZou, Hengxiang Gong[4] Solar increased natural draft dry cooling system (SENDDCT) could be a new heat rejection device victimization alternative energy to reinforce its cooling performance. In a trial to seek out the best structural arrangement of SENDDCT, this paper conducts threedimensional CFD simulations to match cooling performances of varied style choices. The simulations start by investigation whether or not the look possibility with lower-height heat exchangers at collector entrance has higher cooling performance than that with partial blockage at an equivalent location.

Guanhong Zhang, Suoying He, Zhiyu Zhang[5] Evaporative pre-cooling with wetted-medium can improve heat exchange of natural draft dry cooling towers (NDDCTs) in hot days (usually in summer). However, the media introduce further pressure drop that reduces the air flow of a NDDCT, and as a result, impairs the tower performance. Students studied the impact of state change pre-cooling on performance of cooling system through experiments or simulations

by taking into thought every the advantage of state change pre-cooling and additionally the disadvantage of further pressure loss. Performance analysis of a low approach low temperature direct cooling tower for high temperature building cooling systems by Mehdi Nasrabadi, DonalP.Finn[6] . For certain temperate climate varieties, cooling towers have the potential to provide hot temperature chilled water, that when used in conjunction with bright and displacement cooling technologies, have prompted interest throughout this idea as a potential approach for the acquisition of buildings. The feasibleness of the projected system depends principally, on achieving low approach water temperatures at intervals Associate in nursing fittingly designed cooling system, at acceptable levels of energy performance. Design of cooling tower. by b bhavanisai, i swathi, k s l prasanna[7] (2016) Has delineate an in depth methodology of a evoked draft cooling system of counter flow kind throughout that its efficiency, effectiveness, characteristics area unit calculated. The technical info has been taken from a mechanical draft cooling system. Cooling towers area unit heat removal devices accustomed transfer methodology waste heat to the atmosphere. Cooling towers produce use of evaporation whereby variety of the water is vaporized into a moving air stream and later discharged into the atmosphere. Prediction of blade resonance of cooling tower fans using vibration analysis By boxes, shafts, and engines offers early warning of machine failures. Performance analysis of Natural draft wet cooling tower at optimized injection height Lalok Singh, Sanjay Soni, R. S. Rana[9] Cooling tower is associate integral a part of thermal power generation plant. Essentially cooling square measure heat rejection devices accustomed transfer waste heat to the atmosphere. Investigation involves the two-dimensional process fluid dynamics model supported actual reference conditions. Temperature and humidness within the tower square measure having main influence on the performance of natural draft cooling.

III. METHODOLOGY

Open evaporative recirculating cooling water systems share a common set of operating objectives. At the most basic level, the prevention of any unplanned loss in production, whether due to inadequate heat exchange or capital equipment failure is of paramount importance. Total production loss aside, the impairment of production operations must be avoided as well. While production may continue, throughput or yield can be constrained, and/or extremely highdemand for energy, resulting in unfavorable production economics. With the basic requirements satisfied, the focus turns to optimizing the total cost of cooling operations over time without disrupting production, experiencing catastrophic loss, or compromising safety, and with the greenest footprint possible.

While the basic goals haven't changed much, the challenges to achieve them have. The primary levers of optimization are threefold. The first is the optimization of chemical application: applying the right amount of chemicals at the right time with minimal variation to ensure system performance. Continuously applying chemicals to protect against an episodic "worst case" scenario is simply no longer economically acceptable or warranted. The secondlever is the minimization of fresh water consumption. As freshwater becomes increasingly scarce and expensive, higher cycles of concentration and/or confident use of alternative, lower quality source waters, can provide the solution to fresh water availability constraints. Finally, there is human productivity. Since most businesses are engaged in their own increasingly competitive markets, the reality is they are often stretched for humanresources.

Through automation or other means that simplify and shorten the effort required to achieve favorable results, human resources can be "created." Incremental resources can either be used to perform more desperately needed water management activities that are desperately needed or other important tasks in the plant environment.

Obtaining optimal results from open, evaporative cooling systems requires careful management of the three inter-related dimensions of corrosion, deposition, and microbiological activity (Figure 1). For several decades, this concept has been widely understood and practiced by knowledgeable providers of water management services and operators of cooling systems themselves.

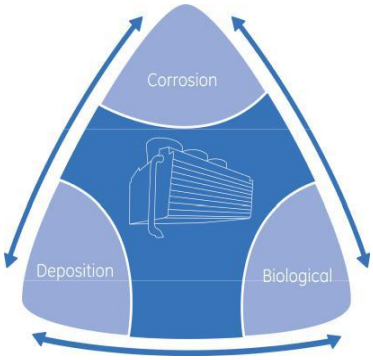

Figure 1. Dimensions of effective cooling water management.

LADDER DIAGRAM:

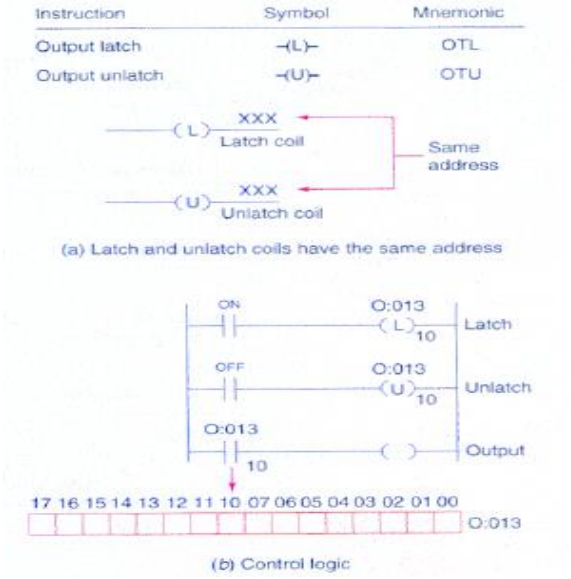

Figure The outputs that have a TRUE logical function, evaluatedfrom the left to right and from the top to the bottom, are energized

RS LOGIX 500:

The RSLogix family of IEC-1131-compliant ladder logic programming packages helps you maximize performance, save project development time, and improve productivity. This family of products has been developed to operate on Microsoft Windows operating systems. Supporting the Allen-Bradley SLC 500 and MicroLogix families of processors, RSLogix 500 was the first PLC programming software to offer unbeatable productivity with an industry-leading user interface.

RSLogix 500 programming package is compatible with programs created with Rockwell Software DOS-based programming packages for the SLC 500 and MicroLogix families of processors, making program maintenance across hardware platforms convenient and easy.

IV. CONCLUSION

This project titled ' ENERGY SAVING OF COOLING TOWER BY USING PLC' is a combination of software programming and hardware interfacing circuit designed for the automatic control and power saving of the cooling water. Our proposed system uses programmable logic controllers and variable frequency drives.

Techno economic analysis shows that there could be a greater improvement in the power consumption and also in expenditure.

"Thus precise and economic utility of resources such as fuel, water and energy can be achieved by implementing PLC automation in Industrial as well as private scale sectors".

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