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Sugar Factory Boiler Automation

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***Abstract*—** The boiler control through automation is the main purpose of this paper. In this paper, we are going to explain one of the effective methods for automation. It describes the effectiveness of automation using PLC and SCADA systems for boiler in sugar factory automation. This paper represents a programmable logic controller (PLC) control system that is applied to the water tube boiler which will increase high quality and greater efficiency. This system monitors boiler`s temperature, pressure and level via different sensors which provide input to PLC. The output of PLC controls the boiler temperature and level and gives out the user required volume of steam. All pressure and temperature variations are shown on SCADA screen and are controlled through SCADA. Different automated check valves are used to release pressure and to inform the concerned authority through alarm in case of an emergency. To reduce human errors we use automation due to which at least the errors occurring due to human workers involvement can be suppressed.

***Keywords*—** Programmable logic controller (PLC); SCADA.

I. INTRODUCTION

A boiler system is main component of a sugar plant. Boiler is defined as a closed vessel in which steam is produced from water by the combustion of fuel. The main inputs of a sugarcane plant are fuel, feed water and air. Generally, in boilers steam is produced by the interaction of hot flue gases with water pipes which is coming out from the fuel mainly coal or coke. In boilers, chemical energy of stored fuel is converted into the heat energy and this heat energy is absorbed by the water which converts them into a steam. The control of water level in the drum of the boiler is a critical Operation. Nowadays, instead of conventional techniques modern techniques are being used in the industries. The multipurpose boiler system installed in the Sugar Industry produces by-products like Heat, Steam and Chemical Gasses etc. In many industries the generated steam by boiler is used for electricity generation purposes instead of going to waste .Numerous controlling mechanisms are used to control the boiler system so that it works firmly The outputs of the system are electrical power, heat loss, steam pressure, steam temperature, blow water and flue gases. The conventional systems today at Sugarcane Industries operate manually; i.e. fuel and water supply to the boilers is manually provided. Hence it requires labour work. In this paper we are suggesting some automation techniques to reduce the human efforts. Reduction in human hazards, time wastage and electricity wastage can be provided by automation in light switching inside the industry. The boiler control which is the most important part of any power plant, and its automation is the precise effort of this paper. In order to automate a power plant and minimize human intervention, there is a need to develop a SCADA (Supervisory Control and Data Acquisition) system that monitors the plant and helps reduce the errors caused by humans.

While the SCADA is used to monitor the system, PLC (Programmable Logic Controller) is also used for the internal storage of instruction for the implementing function such as logic, sequencing, timing, counting and arithmetic to control through digital or analogue input/ output modules various types of machines processes. Systems are used to monitor and control transportation.

Present system: Previous days, Steam was apply to the boiler process is not periodically. It provides uncontrolled steam to the boiler for heating. Therefore, wastage of steam is more.

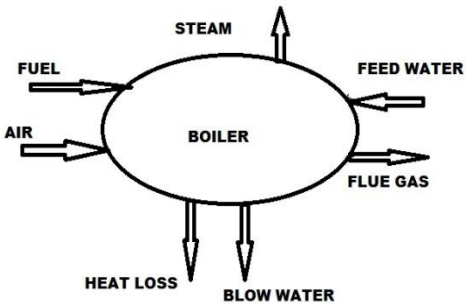

Fig. 1. Basic structure of boiler.

Proposed system: So far, the steam generator is controlled only by manually. Now the process is fully automatic and analysis of status obtained in SCADA. Applying Steam is controlled by PLC. So, efficiency of heating the boiler by use of steam is to be high.

II. WORKING PRINCIPAL

This paper demonstrates the automation system in which water supply to the boiler is automatic, as per the Requirement. Now day's water supply to the boiler is a manual process. Usually electricity wastage is high in bigger industries. The main purpose of this paper is to reduce electricity wastage and reduce human efforts. According to the measurement of the boiler's temperature, it gives readings on graphical LCD and then as per requirements of water to the boiler. Automatic water supply will be provided to the boiler.

III. CONTROL PARAMETERS

i. Level Control-Steam Drum level

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ii. Pressure Control-Force draft pressure, Induced draft pressure, Steam drum pressure, Turbine inlet steam pressure,
iii. Flow Control -Steam flow, Water flow
iv. Temperature Control -Steam drum temperature, boiler temperature, Turbine inlet steam temperature, Flue gas temperature.

IV. Boiler Operation

Water plays a major part in the generation of steam. Inlet water to the steam drum should be in purified form, for that, PH value of the water should be maintained, and stored in tank. Feed water pump is switched ON by using feed water pump switch. The water from the tank is allowed to pass through pipes. In one pump the flow rate is maintained. The heated water is made to flow through steam and water drum. In this, water should be maintained at least at 50%. For sensing water level we use controller in ABB PLC. When the level is lesser than or greater than 50%, controller senses the level change and sends the appropriate control signal to the feed water valve. Thus, in spite of any changes in disturbance variable, the water level can be maintained at 50%. Water in the water drum is maintained at more than 75%. This water is circulated back to steam and water drum, due to difference in temperature, high amount of steam is generated. The generated steam temperature may be greater or lesser than the desired temperature. So depending on the situation the generated steam is then passed through heater. The temperature is monitored on SCADA screen.

V. Automation

Delegation of Human Control to technical Equipment aimed towards achieving.

Advantages: Higher productivity, Superior quality of end product, efficient usage of raw materials and energy, improved safety in working condition. Reduced space requirements, energy saving, less maintenance and hence greater reliability. Implementation of changes in the control logic as well as reducing the project lead- time was not possible.

Programmable Logic Controller In this, instead of achieving desired control and automation through physical wiring of control devices, it is achieving through program say software.

VI. Conventional System

Conventional equipment systems are prone to errors due to the involvement of humans in the data collection and processing using complicated mathematical expressions. Thus what we require is a system that collects raw data, processes it and presents it in values which can be verified and compared with the standard values. In the coding process of this implementation with PLC controller, it requires a fast and efficient processing. All the values can be filled up by the introduction of the automation technique into the power plants. The automation technique involving the automatic control of all the processes which includes the monitoring and inspection needs provides for a very efficient system. The automation process helps the company having the power plant to reduce the amount of errors that occur , reduction in the human resources, increased efficiency, and most importantly very cost effective.

VII. Fuels

The economic viability of the cane sugar industry largely depends upon the use of bagasse as a fuel to generate power and process steam. In a well-balanced raw sugar factory the quantity of bagasse available should be just sufficient to meet the total energy load. Bagasse and hogged wood have similar characteristics, but differ radically from the other two. On a dry basis their chemical characteristics, as with most fibrous fuels, are almost identical, i.e. they have low ash and high volatile contents. Physically in the "as fired" condition they have high moisture contents, and low calorific values and bulk densities. The average Natal bituminous coal is free burning, has a high ash fusion temperature (plus 1,400" C) and exhibits reasonable swelling characteristics. Its bulk density is about eight times that of bagasse, while from 15-20 times the volume of bagasse must be burnt for an equivalent heat output. Both light and heavy oils are used in the industry for an equivalent heat output. Both light and heavy oils are used in the industry.

Light oils, because they require no pre-treatment, are instantly available and are therefore preferred as an emergency standby fuel. Cheaper heavy oils are used where an auxiliary fuel must be burnt constantly, i.e. in a mal-balanced factory or where a high off crop load exists.

VIII. Operation in Automation

Initially the boiler is filled with some amount of water and required amount of fuel is fed. According to the procedure required contents are added to boiler to produce sugar. When the boiler temperature goes high or low, then its value is digitally flashed on graphical LCD. If the temperature goes high, it means water should be added to boiler and so water will be provided automatically to the boiler. We have provided solenoid valve to boiler for water supply. Whenever there is need of water in the boiler, the temperature will raise (due to continuous heating) and the solenoid valve will open automatically and water is supplied to the boiler.

IX. Hardware

- PLC (ALLEN BRADELY PM554)
- SCADA System (ABB)
- SMPS (24v DC)
- Temperature sensor (Pt100)
- Converter (Pt100 to voltage)
- Pressure relief valve
- Pressure gauge
- Solenoid valve

VIII. Software

- Control Builder Plus
- Panel Builder 600
- SCADA Screen OR HMI

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IX. SCADA

Stands for Supervisory Control And Data Acquisition. As the name indicates, it is not a full control system, but rather focuses on the supervisory level. As such, it is a purely software package that is positioned on top of hardware to which it is interfaced, in general via Programmable Logic Controllers (PLCs), or other commercial hardware modules. SCADA systems are used not only in most industrial processes: e.g. steel making, power generation (conventional and nuclear) and distribution, chemistry, but also in some experimental facilities such as nuclear fusion. The size of such plants range from a few 1000 to several 10 thousands input/output (I/O) channels.

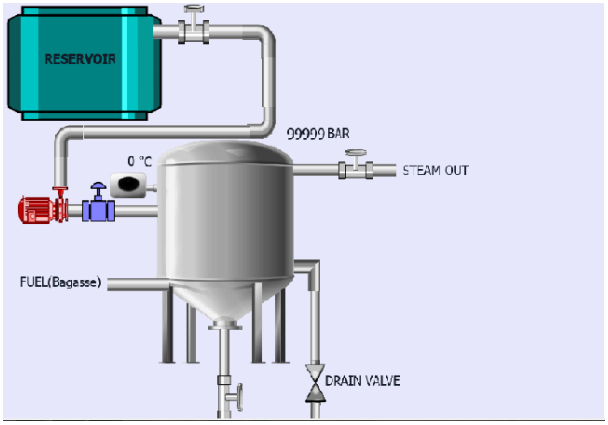

Fig. 2. SCADA screen.

X. ADVANTAGES

The main advantage of using boiler in sugar factory is low factory waste would be washout of factory. Co-GENERATION plant would produce enough electricity to power up the unit. Therefore the factory doesn't depend upon another power resource. The leftover ash after burning the bagasse can be used to produce fly ash bricks.by this automation system production cost can be reduced to get maximum profit.

XI. CONCLUSION

The most important aspect of any cogeneration plant is the boiler control. Several techniques can be implemented but, the method that has to be used relies on varied objectives like superior quality, increased efficiency, high profit depending upon the purpose of the company that implies it. The changes that are recently taking place in the scenario of the industrial segment. Emphasis has been given to the automation process that is now rapidly taking its place in all the power plants across the globe. The Paper has furnished itself to study the integral parts of the entire process involved, their implementation and the problems that may show up have also been given their due importance

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REFERENCES

[1] S. Chopade, P. Verma, and P. Verma. "Simulation of boiler control using PLC & SCADA," *International Journal of Engineering and Advanced Technology (IJEAT)*, vol. 3, issue 3, 2013.

[2] K. G. Shankar, "Control of boiler operation using PLC – SCADA," *Proceedings of the International MultiConference of Engineers and Computer Scientists*, vol. II IMECS 2008, Hong Kong, 2008.

[3] N. Magasiner, "Boiler design and selection in the cane sugar industry," *Proceedings of The South Afvican Sugar Technologists Association*, 1966.

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