

Review on Performance Evaluation of Sugar Industry Through Energy Conservation

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Abstract

Industrial sector plays very important role in global energy consumption. Sugar industries are one of the most energy consuming industries. Increasing trend in setting up of new sugar industries and capacity enhancement of existing sugar plants in India is alarming to energy requirement. These industries consume considerable amount of energy for production viz a viz generate the energy as cogeneration. The energy conservation in such plants is paid less attention as compared to that in developed countries. Energy auditing is a powerful tool, which has been successfully and effectively used in the design and performance evaluation of energy related systems. Also there is a need to promote recycle economy, energy generation, facilitating technological progress, reduce consumption, and protect the environment. Hence, energy efficiency and conservation should be viewed as new source of energy along with energy cogeneration.

Key Words: Sugar Industry, Energy Conservation, Efficiency, Performance, Audit.

1.Introduction

Sugar industry consumes a considerable amount of energy for production of sugar. But the awareness on energy efficiency in Sugar Industries in India is still low as compared to that in developed countries. Less importance is given to energy efficiency in sugar industries as most of them are running cogeneration plants. By knowing the process and co-generation equipment's power consumption and by evaluating their operating efficiencies, energy efficiency of these equipment's can be improved which results in reduced energy consumption. Now a day, production of electrical energy from sugarcane fibre (bagasse) is assuming great importance due to renewable nature. Improvements in energy and process efficiency in the sugar industries can make them energy self-sufficient and capable of exporting excess electricity to the national grid. The incorporation of energy efficiency measures can be done for new plants starting from the design stage and as retrofit for existing plants. This paper tries to take a review the work done in the energy efficiency during the production of sugar and generation of energy as a renewable source.

Literature Review

A number of research papers have been published on energy conservation and generation in the sugar industry. Brief reviews of few selected papers are presented here.

Lavarack B. P., et.al. (2004) has tried to improve energy efficiency of sugar factories for increased product diversification, namely, increased steam production for export to a collocated production facility, increased bagasse manufacture and increased electricity cogeneration. They observed that low pressure (LP) steam efficiency as measured by the steam on cane was decreased from about 51.6% to less than 40% by increasing steam production for export to a collocated production facility (e.g. distillery), increasing bagasse manufacture (e.g. pulp mill) and increasing electricity cogeneration.

Pathak A. N. (1997) has carried out the study of Indian industries on major process involved in sugar factory and their energy consumption. It has been concluded that in cane preparation stage, the energy can be saved by proper use of electronic motors with 15 to 17% slip for driving cane knives. In case of milling section, energy consumption can be optimised by using 5 numbers of 3 roller mills by adjusting the mill speed to 10-11 meter per minute with 2 roller pressure feeders and roughing hard surfacing of the mill roller cells. And by optimising operating speed of the mills in close proximity of the rated speeds of the mill turbine and by using close multi stage helical gear boxes to improve transmission efficiencies.

Singh I. (2001) has discussed the methodologies used to launch and manage the Malelane energy Conservation Programme. In his paper, the impact of type of technology and time efficiency indices for energy usage management

has been listed and a limitation of some energy indices has been discussed. Singh has concluded from the Malelane Mill experience that a systematic project management approach supported by a reliable energy management information system is the key ingredient for a successful energy conservation programme.

APPCB (2004) highlights the energy efficiency aspects at the design / project stage. It has been concluded that the energy efficiency plays a vital role in the survival of the sugar and distillery industries in the existing scenario and hence energy conservation studies and demonstration projects shall be encouraged.

Sourena Sttari, et.al. (2007) has discussed various energy auditing methodologies and the energy conservation opportunities in sugar industry with the aim to determine energy situation and the possible energy saving potentials in sugar industries in Iran. They observed that 561176336.3 cubic meters of natural gas thermal saving per year and 23220627.15 KWh/year of electrical saving from 17 plants. With this observation, authors had concluded that promoting recycle economy, facilitating technological progress, reduce consumption, and protect the environment are the important measures to help the industry to reduce energy cost.

Rao T. B., et. al. (2011) has discussed the effect of environment audit to reduce energy and water consumption and use bagasse as fuel at Kumbhi-Kasari Sugar Factory situated near Kolhapur, Maharashtra, India. The factory has been taking care to avoid pollution by providing good drainage facility, locating ETP near housing colony and general cleanliness of the area. The factory has planted around 2000 tree in the factory premises as a outcome of environment audit.

Malhotra Neena and Sehgal Shivani (2012) has observed that about 70% of energy has been consumed by induction motors in a sugar mill and hence they had studied the rewind induction motors of different horsepower for different types of losses to determine the overall efficiency of the induction motors in the sugar industries. While concluding it has been stated that if the efficiency of rewind induction motor found near to the rated efficiency of that motor, then there is no need for any change, however, if the efficiency of rewind induction motor found low as compared to rated efficiency of that motor, then it is better to replace that motor with new one.

Nangare S. P. and Kulkarni R. S. (2012) has analysed energy utilisation measures through energy audit in sugar industry power plant through its performance in overall efficiency, cogeneration by utilizing measure as the input feed air. It has been observed that around 40 to 50% extra feed air removes 10 to 13% of energy from boilers and influences on boiler efficiency. They have concluded that 10% of total electricity generation can be enriched by correction in extra air as an ultimate measure in the efficiency improvement of power plant.

Narasimha Rao G. R. and Nagarajan M. (2012) has discussed on energy efficiency in Indian sugar industries with reference to the comparison of specific energy consumption of energy inefficient and energy efficient sugar plants with reference to the major energy consuming equipments/sections. They revealed that tremendous scope has been exists for improving energy efficiency. Specific Energy consumption can be reduced to the tune of 22kWh to 26kWh/tonne by incorporating various energy efficient equipment's like, VFD, energy efficient transmission gears, pumps and motors, etc. Improving energy efficiency in sugar industries gives the opportunity to generate and export more power from their co-generation plant.

Charles Mbohwa (2013) has carried out the studies in the South African sugar industries and identifies as the energy management practices are necessary to increase the efficiency of the cogeneration processes. In conclusion it has been stated that to improve factory energy efficiency, the equipment and technological improvements coupled with process design improvements are necessary.

Chouhan Paras, and Chandrakar Avin (2014), studied the performance enhancement of sugar mill by alternate cooling system for condenser. The absorption chiller arrangement is treated as the efficient method of utilization of waste heat for cooling condensed water.

Chougule G.A., et.al. (2016) has carried out detailed specific study of energy to investigate the energy requirement for distillery plant especially in boiler operation by using waste heat recovery equipment. It has been observed that the boiler has a scope of improving efficiency by increasing feed water temperature with waste heat recovery equipment such as PHE or economizer. Initially the efficiency of the boiler was 63.43% with feed water temperature of 40°C but by increasing the feed water temperature it became more than 70 % and reduces the consumption of fuel as bagasse.

2. Conclusions

From the above literature review, it is observed that the energy conservation in such plants is never being given more attention by previous researchers. There is a lot of opportunities for energy saving exist in the sugar industry. Energy auditing is a powerful tool, which has been successfully and effectively used in the design and performance evaluation of energy related systems. Also there is a need to promote recycle economy, energy generation, facilitating technological progress, reduce consumption, and protect the environment. Hence, energy efficiency and conservation should be viewed as new source of energy along with energy cogeneration.

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