Int. J. of Thermal & Environmental Engineering
Volume 1, No. 1 (2010) 29-36

Energy Use, Energy Savings and Environmental Analysis of Industrial Boilers and Compressors

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Abstract

In this paper energy use , energy and bill savings, emission reduction and pay period using high efficient motor, variable speed drive by modulating speed of boiler and compressor has been estimated using energy audit data. It has been found that 68,923 MWh, 132,922 MWh, 78,769 MWh and 49,230 MWh of energy can be saved for 40%, 60%, 80% and 100% motor loadings, respectively for 20% speed reduction in the boiler system. Corresponding bill savings for the aforementioned energy savings have been found to be US$ 4,411,052, US$ 8,507,028, US$ 5,041,202, and US$ 43,150,751 for 40%, 60%, 80% and 100% motor loadings, respectively for 20% speed reduction in the boiler system. Energy savings and bill savings resulting from the use of high-efficiency motor in air compressor are 6703 MWh, 8251 MWh, and 10571 MWh, total energy, can be saved for 50%, 75%, and 100%, motor loadings, respectively. Similarly, bill savings for the preceding amounts of energy savings are US$ 428,984, US$ 528,042 and US$ 676,538, respectively. It is also clear that the use of high efficiency motor and VSDs leads to substantial energy savings and an enormous reduction in emissions.

Keywords: *Energy, Energy savings, Environment, Boiler, Compressor.*

1. Introduction

Energy efficiency improvement is one of the most important functions to reduce energy cost as well as production cost in the industries. Energy efficiency improvement is the main objective of many national energy policies. Monitoring of the energy consumption and developments in energy efficiency is necessary in order to check and apply desired policies. Energy is the most important sector for automation and modernization. Automation and modernization is increasing rapidly day by day in the industrial sectors. Steam and compress air systems are a part of almost every major industrial process today. All of the major industrial energy users devote significant proportions of their fossil fuel consumption to steam production: food processing (57%), pulp and paper (81%), chemicals (42%), petroleum refining (23%), and primary metals (10%). Since industrial systems are very diverse, but often have major steam systems in common, it makes a useful target for energy efficiency measures [1]. Nearly 45% of global electricity generation is derived from coal while natural gas and nuclear energy makes up about 20% and 15% respectively of the world's generated electricity [2]. Most heating systems, although not all, employ boilers to produce hot water or steam. Boiler efficiency therefore has an important influence on heating-related energy savings. The energy savings that can be achieved by improving overall boiler efficiency can be substantial. Essentially a boiler is a device in which a fossil fuel is burnt and the heat produced is transferred to water. Heat can be lost from boilers by a variety of methods, including flue gas losses, radiation losses and, in the case of steam boilers, blow-down losses [3]. To optimize the operation of a boiler plant, it is necessary to identify where energy wastage is likely to occur. A significant amount of energy is lost through flue gases as all the heat produced by the burning fuel cannot be transferred to water or steam in the boiler. The efficiency of boiler is a measure of the ability of it to generate the steam demand from a given fuel supply. Boiler efficiency is very dependent on the excess air rate. Excess air should be kept at the lowest practical level to reduce the quantity of unneeded air that is heated and exhausted at the stack temperature [4]. Most of the heat losses from the boiler appear as heat in the flue gas, the recovery of this heat can result in substantial energy savings [5, 6].This indicates that there is huge savings potentials of a boiler energy savings by minimizing its losses. By introducing variable speed to the driven load, it is possible to optimize the efficiency of the entire system, and it is in this area that the greatest efficiency gains are possible [7, 8]. Use of compressed air in industry and in service sectors is common as its production and handling are safe and easy. In most industrial facilities, compressed air is necessary to manufacturing. Compressed-air generation is energy intensive, and for most industrial operations, energy cost fraction of compressed air is significant compared with overall energy costs. There is a vacuum of reliable information

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DOI: 10.5383/ijtee.01.01.005