

Steam System Optimization at Palm Oil Mill: Case Study in Sabah, Malaysia

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Abstract

In this paper, a preliminary study of industrial steam system reveals that most of the industrial steam user especially the palm oil mill did not bother to save energy as long as the mill meets their productions target and is getting profits for the company. The management is not aware that a huge amount of energy is being wasted during the processes of extracting oil from the fresh fruit bunch (FFB). To embark this study, Steam System Scoping Tool (SSST), Steam System Assessment Tool (SSAT) and 3E Plus: Insulation Program Software, provided by the United Nations Industrial Development Organization (UNIDO) are used to assess the efficiency of steam system operations. The tools also assist in preliminary assessments of how efficiently the steam system is operating. After analyses are conducted, the proposed improvement project is recommended to modify the system back to its initial designed best efficiency. The results also show that there were various losses that are contributing to the energy waste and its cost impact to the mill. Meanwhile, the boiler efficiency was only about 68.6%. The findings proposed steam system optimization (SSO) opportunities by installing the feedwater economizer and reducing the blowdown rate of the boiler. The efficiency of the boiler was increased to 77% from its current operating condition. This also improved the steam quality and production output of the mill. Through these SSO, the annual demand saving is around 4.9 MW, with an energy saving of 75,276 GJ/yr., capable of reducing 13,002 metric tons of carbon dioxide emissions per annum and save 598.3 Tph/yr of biomass fuel. Thus, through this steam system optimization the estimated annual net cost savings are around USD 100,000.00. This paper aims at promoting similar system optimization projects at other plants throughout Malaysia, as it benefits to all industrial steam user especially the palm oil mill industries in Malaysia.

Keywords: Palm Oil Mill; Energy Saving Opportunities; Steam System Optimization; Steam System Tool Suite

1. Introduction

Energy is the main driver for the organization of the mill to keeps its operation moving. System optimization is the method to identify the amount of savings achievable and to ensure the equipment throughout the mill is operated in an optimum condition. It is common for palm oil mills that has been operated for decades to stray out from their initial ideal control parameters settings. Due to that, system will be operated inefficiently, where losses will occur. In order to understand the efficiency of the whole system of the mill, each of the major components of the industrial steam system need to be isolated and evaluated based on each major area of the systems. Any generic steam system either in industrial, commercial or institutional will have four major areas which are generation, distribution, end-use and condensate recovery as can be seen in Figure 1. Each of these areas have their numerous component which may or

may not exist in medium or small steam user. The proficiency of each component may affect the overall system efficiency (Chowdhury et al., 2018).

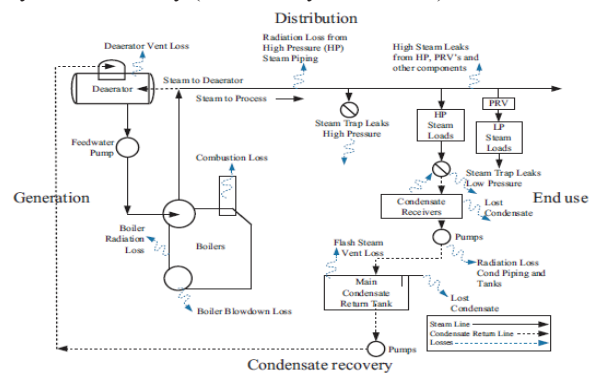


Fig. 1. Generic Steam System Schematic (adapted from (Chowdhury et al., 2018))

The data from industry states that the average steam energy usage could be as much as 35-40% of the onsite energy usage. Thus, implementing the optimization and minimizing their operating costs is crucial (Industrial

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