Thesis Title	Heat and Power Integration in Sugar cane Factory
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Abstract

This thesis aims to apply Pinch analysis for energy cost reduction in a large sugar cane factory. The capacity of the factory is 22,000-23,000 tons cane/day and the average minimum steam consumption per tons cane crush is 440 kg steam/ton cane. This factory produced 432.8 ton/hr high pressure steam at 30 bar_a and 360^{O}C. This steam was mainly used to produce 20.7 MW mechanical work and 17.8 MW_e electricity, of which 2.8 MW_e was sold to the grid. Some steam, after passing through pressure reducing value, was used for sugar drying and as auxiliary steam for the processes by combining with the back pressure steam from turbines. Abuot 10.27 ton/hr of high pressure steam were sold to a neighboring factory.

The three energy management schemes for this factory, base on technical feasibility, were proposed in this study. First, the auxiliary and drying steam are fed to a steam turbine to produce electricity before being used in processes. The analysis showed an increase in electrical generation of about 1.54 MW_e with some investment for drying air preheater area expansion. This option was found to be infeasible due to space limitation. Therefore only auxiliary steam is fed through steam turbine to produce 1.35 MW_e more of electricity or $2.96x10^6$ kWh/yr more of electrical energy without major investment. The increase in income is about 3.58 MBaht/yr. In the second case, Pinch analysis was used to reduce the steam consumption rate with the same amount of work and electricity production. It was found that the reduction of steam consumption can save 10,595 tons/yr or 2.65 MBaht/yr of fuel with 275,000 Baht of investment for revamping heat exchanger area, and the 10% discount payback period is 1.25 months. If the

saving fuel is used to produce electricity and refine raw sugar, the generated electrical energy, which can be sold, is about 8.89×10^6 kWh/yr or 1.075 MBaht/yr and the value added for refined sugar is about 32.8 MBath/yr. The payback period at 10% discount is 2.9 days. The third case is similar to the second, but only the same amount of produced work is considered. The fuel saving is about 20,583 ton/yr or 5.15 Mbaht/yr, while the decrease in electrical energy generation is about 3×10^6 kWh/yr or 3.63 Mbath/yr. The investment cost for installing more heat exchanger area is 12.3 Mbaht, which yields unacceptably long payback period for this option. However can generate 1.73×10^6 kWh/yr more of electrical energy or 2.09 Mbaht/yr more of income, and produce more refined sugar with 60 Mbath of value added from the same amount of saving fuel. The option gives 2.76 months payback period at 10% discount.

Keywords : Pinch analysis / Sugar Cane Factory / Cogeneration / Energy Management