Thesis Title	Thermal Energy Analysis in a Tapioca Starch Factory	
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Abstract

This thesis is concerned with the investigation of energy use in hot air generator in tapioca starch factories with an objective of finding possible energy saving. Energy audits were conducted in 10 tapioca starch factories and it was found that there are two methods to generate hot air for the tapioca starch drying processes, hot air boiler and thermo-oil boiler. The total specific energy consumption is found to be 2.806 MJ per kg of tapioca starch which consists of 2.125 MJ per kg of tapioca starch as specific thermal energy consumption and 0.681 MJ per kg of tapioca starch as specific electrical energy consumption.

Fuel oil was used in the boilers as the main source of fuel which operates continuously 24 hours per day. By an energy analysis, the average first-law and second-law of thermodynamics efficiencies and irreversibility of boilers were evaluated and found to be 71.16%, 25.28% and 70.64% respectively. For the hot air boilers, the average first-law and second-law of thermodynamics efficiencies and irreversibility were evaluated and found to be 69.76%, 17.11% and 78.93% respectively and for the thermo-oil boilers, the average first-law and second-law of thermodynamics efficiencies and irreversibility were evaluated and found to be 73.27%, 37.55% and 58.21% respectively.

The thermal energy savings can be achieved by the improvement of combustion efficiencies which will save 4.34 million Baht per year with a pay-back period of 0.09 year. The installation of air-preheater which heat is transferred from flue gas to ambient air will save 1.02 million Baht per year with a payback period of 7.34 years. Changing the

grade of fuel oil from grade A to C will save 1.21 million Baht per year with no investment cost. The installation of proper fiber glass insulation will save 303,110 Baht per year with a payback period of 7.55 years.

The feasibility study to utilize the cogeneration system to replace the thermal-oil boiler in large scale factory by using lignite and grade C fuel oil was conducted. Results indicated that by using lignite,the cogeneration system can produce 1483 kW and sufficient thermal energy for the drying system. The investment cost is 63.7 million Baht will return the investment cost within 2.71 years with 39.05% of EIRR (Economical Internal Rate of Return). By using grade C fuel oil, it was concluded that the payback period is more than 25 years and the EIRR is less than zero.