

Effect of Solar Fraction on the Economic Performance of a Solar AirConditioning by an Adsorption Chiller

F. Basrawi^a, K Habib^b, H. Ibrahim^a, GC Lee^a

^aUniversiti Malaysia Pahang, Faculty of Mechanical Engineering, 26600 Pekan Pahang

^bUniversity Technology Petronas, Department of Mechanical Engineering, 31750 Tronoh, Perak

ABSTRACT

Solar cooling is a promising way for a sustainable air-conditioning system. However, since solar has intermittent output, it is usually backed-up by a conventional heater. Thus, it still needs electricity or fossil fuel to operate stably. This study presents the effect of ratio of heat delivered by solar to the total heat delivered to an adsorption chiller (solar fraction) on the economic performance of a solar cooling system. This cooling system need covers cooling demand for an office building in a tropical region (Kuala Lumpur). Cooling demand was simulated using well-known energy analysis software for building, Equest. Flat-plate collectors and an adsorption chiller were the main component of the cooling system. Flat-plate collectors were simulated using another software, Watsun, and the adsorption chiller was based on our simulation model that is comparable with other studies. Economic performance was analyzed by life cycle cost analysis. Solar fraction of 0.33, 0.74 and 0.98 were studied. It was found that none of the solar fraction studied can generate Net Profit under subsidized electricity. It was also found that a natural gas boiler is a better solution than an electric heater as an auxiliary heater in term of economic. For a natural gas boiler, Net Profit increased when solar fraction decreased; the highest one was solar fraction of 0.33 with US\$15,600. However, since more energy is used for the auxiliary heater in lower solar fraction, more emissions is expected to be released. Thus, emissions for all solar fraction need to be considered and studied further.

KEYWORDS: Solar Cooling, Adsorption Chiller, Solar Fraction, Economic