no mixing losses yields COP values not much less than the Carnot values. Once mixing losses are allowed to affect the results, using either an ideal gas model or a real gas model, the COP values drop markedly due to the internal irreversibilities or lost work. Hamner also reports experimental data on such an ejector-operated refrigeration cycle, rated at approximately one ton of refrigeration and employing R-11 as the refrigerant. Experimental COP values of about 0.10 to 0.25 were obtained for pressure ratios (P_S/P_C) of 5.0 to 7.5.

CONCLUSIONS

This article has demonstrated the applicability of the HYSYS computer-aided process design system to the simulation and analysis of a solar-powered refrigeration cycle. While such a cycle consists of a number of standard chemical process equipment items such as heat exchangers, a pump, and an expansion valve, the key hardware element in this cycle is a thermal compressor or jet ejector. Models of the latter item, while a relatively common piece of processing equipment in the chemical and allied industries, are not that extant in computer-aided process design systems such as HYSYS or comparable software packages. The employment of an adjust or control module to balance the work of a compressor and an expander in a cycle was illustrated in this work.

The coefficient of performance (COP) values for refrigeration cycles driven by a solar collector and jet ejector are admittedly much smaller than those of conventional cycles employing mechanical compressors. As numerous authors[1-3] have pointed out, however, applications of the former may be economical in cases wherein the required input heat is very inexpensive (*e.g.,* solar energy) or it would be otherwise wasted, as from the cooling system of an automobile engine. And there are certainly more than just technological factors operative in this arena.[4] Lastly, it should be remembered that the energy input to a mechanical vapor-compression refrigeration cycle generally originates from an electrical power plant. This power often derives from the combustion of a fuel with a process efficiency of about 33%. Thus, the ultimate amount of energy required in such a mechanical cycle is roughly three times the amount actually supplied to the compressor.

TABLE 8
Influence of Heat Rejection Temperature (T_0) on COP and Efficiency Values ($T_R = 40°F$, $T_S = 200°F$)

Rejection Temperature (T_0), °F	Refrigeration Cycle $(COP)_C$	Efficiency of heat engine (E_C)	Overall cycle COP [$=(COP)_C(E_C)$]
125	5.882	0.1136	0.6684
110	7.143	0.1364	0.9740
100	8.333	0.1515	1.2626
90	10.000	0.1667	1.6667
77	13.514	0.1864	2.5184

Perhaps the major contribution of this work is of a pedagogical nature. Thus, this study of a solar-powered refrigeration cycle, exploring different refrigerants, efficiencies, operating conditions, etc., could represent an excellent computer-aided design project in an introductory engineering thermodynamics course. It is in this spirit that this study was formulated.

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