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[摘要]

本研究以室內溫水游泳池爲研究對象，運用空氣熱泵系統維持室內溫水游泳池空調所需的條件，並以空氣熱泵收集濕後冷空氣再熱所需之熱源及池水的持溫加熱系統上，以達到能源之再利用及節能的效益。
本文中之熱泵系統以壓縮機、冷凝器、膨脹閥與蒸發器等四大部分原件進行設計及搭配 ，除了壓縮機和膨脹閥的器和蒸發器之熱交換器均是由基本的動量、能量守恆方程式開始，經由適當的假設來計算，並分別建立一維的理論料庫。
研究後發現如以不同組合之熱泵與鍋爐供應熱源來做比較，並以生命週期成本來作分析，可得知十年後CaseE之總的方案，以二年之生命週期成本來做分析時，則以CaseB爲最符合經濟效益，而初設成本方面，CaseA最爲經濟。分配比例來做分析，預估五年後以Case3之UAc與UAe導熱度分配比例值爲1.37時與CaseA作比較可節省生命週期元的費用，所以適當增加導熱度分配比例也是增強熱泵性能的方法之一。

[英文摘要]

Objective of this study is to investigate the effect of heat pump system on the Winter indoor swimming pool in wa
controls the indoor temperature and moisture content in swimming pool. It is also used for collecting & recycling t
content. In order to achieve the goal of energy recycling and saving, the recycled heat is further processed for ke
The Heat Pump System was designed by combining four major components such as compressor, evaporator, ex
compressor and thermostatic expansion valve is based on the standardized performance curve provided by the r
evaporator is modeled and calculated by using the fundamental physical laws of mass, momentum and energy c
to establish a consistent theorical model for achieving optimal performance of the components in the Heat Pump
reference.
In this study it was observed that if we compare the heat source from different combinations of heat pump and bo
case E is NT 18,177,380 dollars, which has the greatest economic benefit among the five cases. If the budget of
the best economic benefit. Regarding to initial budget, case A is the most economical one. It was observed that i
distributing ratio of heat conductance between heat exchanger UAc and UAe, it is estimated that after five years
compared with that of Case A, the life expectancy budget of NT 1,729,854 dollars can be saved. The initial budg
increase the distributing ratio of heat conductance is also one of the methods to enhance the performance of hea

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[參考文獻]

[1] Domanski , P. , Dodopm , D “Computer modeling of the vapor compressor cycle with constant flow area ex
Building Science Series No.155.Washington,DC：Department of Commerce, 1983.

[2] Fisher , S. K. , Rice , C.K. , “The oak ridge heat pump models：A steady state computer design model for a
80/R1.Oak Ridge , TN：Oak Ridge National Laboratory, 1983.

[3] Damasceno , G. S. , Rooke , S.P. , Goldschmidt , V.W. , “Comparison of three steady-state heat pump com
205, 1990.

[4] Chen , Z , J. and Lin ,W.H., “ Dynamic simulation and optimal matching of a small-scale refrigeration syster

[5] Wang , Z. Z. and Zhao , Z.N. , “Analysis of performance of steam condensation heat transfer and pressure
14(4), pp.32-41, 1993.

[6] Johansson L. , “Energy savings in indoor swimming-pools：comparison between different heat-recovery sy

[7] Renatio M.Lazzarin and Giovanni A. Longo. , “Comparison of heat recovery system in public indoor swimm
pp.561-570, 1996.

[8] Faye C.M. , “Heating ventilating , and air conditioning” John Wiley&sons, 2003

[9] Dabiri , A. E., Rice, C. K., “A compressor simulation model with corrections for the level of suction gas supe
782, 1981.

[10] Michael , J. M. , “ Fundamentals of engineering thermodynamics”, John wiley&sons,Inc., 2000

[11] Wivert F. S. , “ Refrigeration and Air condition”, McGraw-Hill Inc., 1995.

[12] Dabiri , A. E., Rice, C. K., “A compressor simulation model with corrections for the level of suction gas sup
771-782, 1981.

[13] Jacobs , J. J. , “Analytical and experiment techniques for evaluating compressor performance losses ” , I
Conference, Ray W. Herrick Laboratories, Purdue University, 1976.

[14] Stoecker , W. F., Smith, L. D., and Emde , B. N. , “Influence of the expansion device on the seasonal ener
ASHRAE Transaction, Vol. 87,Part 1, pp.349-359, 1981.

[15] Cleland, C., “Polynomial curve-fits for refrigerant thermodynamic properties: extension to include R-134a”

[16] 李昭仁，環保冷媒R-290應用於冷藏、冷凍系統之性能研究，碩士論文，國立台灣大學機械工程學系，1998年

[17] 王啓川，熱交換器設計(I)，五南圖書出版股份有限公司，2001年2月。

[18] Danfoss Co. ltd. “Collecting of instructions” , Apr.2004.

[19] 范存養，大空間建築空調設計及工程實錄，pp.37-42，1998。

[20] ASHRAE, “ASHRAE handbook2005” , ASHRAE, 2005.

[21] Tassou, S. A. and Al-Nizari , H. O., “Investigation of the effects of thermostatic and electronic expansion v
commercialchillers” , Int. J Refrig. , Vol. 16, pp49-56, 1993

[22] Joseph C. Lam. , “Energy performance of air-to-water and water -to-water heat pumps in hotel application
44, 2003

[23] Auricpool Holding Corp. “ Indoor Pool Dehumidification”, “The Ultimate Dehumidification System”, 200

[24] Stewart R.B. , Jacobsen R.T. and Penoncello S. G., “ASHRAE thermodynamic properties of refrigerants”
of Inaho , American So Heating , Refrigeration and Air-Conditioning Engineers,Inc., 1993.