

Energy Efficiency - System Design Strategies: HVAC Integrated Water Based HVAC with Refrigeration System

Strategy: Design HVAC in conjunction with water-loop heat rejection from the refrigeration; ideally using water source heat pumps and evaporative condensers. In this strategy, a warm temperature liquid is circulated through a low-temperature rooftop liquid cooler. The same warm secondary fluid flows through heat recovery heat pumps. These heat pumps then provide heat to the various parts of the store. The water-source heat pumps use the heat rejected by the low-temperature rack to provide space heating without requiring the condensing temperature and discharge pressure to be raised as in some conventional systems. There are, therefore, substantial energy savings because of the heat pumps' high coefficients of performance. Additionally a conventional heat reclaim coil, located in the central air handler, allows the recovery of between approximately 30 % and 50 % of total heat rejection.

Relevant Store Scale/Type: M-L/Best for new or existing buildings but can be integrated into existing buildings doing upgrades.

Initial Cost:

1. Costs for systems are about 30% above conventional roof top units.

Return on Investment:

1. Energy savings are in the 10% - 20% savings in operating costs over conventional air cooled roof top units with multiplex refrigeration.

Operator Benefits:

1. The more efficient and shorter defrosting cycles, higher average evaporating temperatures, proper insulation of the secondary fluid piping, and close coupling of the compressor racks to the condensers and fluid chillers (evaporators) contribute towards the energy-use savings
2. When using water source heat pumps and evaporative condensers, this strategy produces the best overall savings in operating costs from the recommendations other than those in Advanced Technologies.
3. Minimizes electrical energy consumption for outdoor air preheating.
4. Reduces amount of refrigerant, both generating savings and reducing annual total equivalent warming impact (TEWI).

Technical Considerations:

1. Use an experienced, reliable installer and have a good maintenance contract with them.
2. Heat pumps have high efficiency factors which have an even better performance when water based over air.
3. Employ glycol loops for heat rejection.

Product/Manufacturer Suggestions, Resources & Examples:

IEA Annex 26: Advanced Supermarket Refrigeration/Heat Recovery Systems:

<http://www.ornl.gov/~webworks/cppr/y2003/rpt/117000.pdf>

Improved Supermarket Refrigeration and Heat Recovery System:

http://findarticles.com/p/articles/mi_m5PRC/is_2_112/ai_n24998201

Case Study: Loblaws Supermarket, Canada:

<http://cetc-varenes.nrcan.gc.ca/fichier.php/codectec/En/2005-025/2005-025e.pdf>

<http://cetc-varenes.nrcan.gc.ca/fichier.php/codectec/En/2004-119/2004-119e.pdf>