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ADVANCED EXHAUST-AIR HEAT RECOVERY & AIR CONDITIONING HEAT PUMP – CONCEPTION AND FIELD ANNUAL ENERGY PERFORMANCES

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ABSTRACT

The original configuration and the annual energy performances of an advanced, retrofit heat reclaim & air conditioning exhaust-air heat pump, developed and experimented in a northern Canadian hospital are presented. The heat recovery system aimed to reduce the fossil combustible consumption for heating and their negative environmental effects, improve the internal air quality and medical comfort. The concept includes two heat reclaim stages, a glycol-to-air conventional heat exchanger and a split, reversible air-to-air heat pump between the hospital's exhaust and outdoor air streams. The originality of the heat pump prototype mainly consists in two independent, parallel and vertical circuits, each including two in-tandem hermetic compressors, bi-directional liquid receivers, modulated evaporators, condensers and sub-coolers, a supplementary condenser for summer extreme conditions of operation, and a control strategy allowing to modulate the heating and cooling capacities, and to avoid the inversion of the cycle during the eventual defrosting demands. The results focused on main thermodynamic parameters, seasonal utilisation and performance factors, annual energy savings, etc. during a 12-month period of continuous monitoring. Several improvements were identified in order to improve the global energy efficiency, integration with the other building's heat reclaim devices and their particular strategies of control.