



## **EXTRACT AIR ENERGY UTILIZATION USING HEAT PUMP IN BUILDINGS WITH INDOOR SWIMMING POOLS**

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### **ABSTRACT**

An annual energy consumption simulation is made for one Latvian mansion with swimming pool hall. Building has two main parts: living part (with bedrooms, living room, kitchen, and washing rooms), and a recreation part with 28 m<sup>2</sup> swimming pool, saunas and sports hall.

HVAC system consists of the following elements: heating system with convectors, water-to-water heat pump system cooling/heating concrete slabs in living part, and centralized mechanical extract, with natural outside air intake through the window grilles. Air –conditioning in swimming pool is provided by separate air-handling unit with heat pump - dryer.

In winter the heat pump system heats concrete slabs, utilizing extract air energy through air to water heat exchanger. In summer living room slabs are cooled, and removed heat is used for the swimming pool supply-air preheating.

The annual energy consumption simulation is made with DOE 2.1E core based application, using building's information model (BIM) for the average Latvian meteorological year. Two BIM's are made: for a living part of the mansion and for swimming pool room, using design coefficients for constructions' thermal resistance and indoor air parameters.

Simulation results show, that swimming pool room consumes 77 MWh of heating energy per year. When using heat pump gained energy to preheat swimming pool supply air, annual heat energy consumption decreases to 62 MWh, which means about 20% saving. The heat pump system annual average coefficient of performance (COP) assumed as 2.5.

Paper results can be used by HVAC engineers and architects for ventilation and air conditioning design in other multi-purpose buildings with indoor swimming pools.

Keywords: HVAC energy efficiency, swimming pool, simulation, heat pump.