Integration of a sorption collector coupled with a decentralized mechanical ventilation unit in curtain wall module

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Over the last few years, a growing attention has been given to the integration of active solar technologies into the building envelope, so to increase the renewable energy production share and contribute to reach the goal of net-zero energy buildings. In this context, the layout of an air based solar cooling system integrated into a façade module was designed and assessed in [1] [2]. This solution utilizes a triple state absorption module within a Sydney type vacuum tube solar collector to thermally condition an airflow directed to the internal space reducing the thermal load covered by traditional technologies.

A further development consists in the integration of this solar collector with a decentralized ventilation machine, so that the hygienic airflow can be heated up or cooled down by the sorption collector. In addition, the ventilation unit is equipped with a heating/cooling coil to guarantee the thermal comfort of the room occupants.

The implementation of this system in façade modules would thus replace a centralized ventilation system and a fan coil and allow harvesting the solar radiation to produce renewable energy.

The effectiveness of the sorption collector in this layout and the energy performance of the system are assessed through dynamic simulations for a set of climates and building envelope characteristics.

The results show that a combination of active and passive cooling can greatly limit the use of cooling coil even though the performance varies significantly with climate and façade orientation. On the contrary, the performance in heating have been found quite poor for all configurations studied.