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Residential ventilation with heat recovery as a sustainable key technology for achieving climate targets
(COP- Equivalence study)

Short study with real-world validation

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Abstract

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1. In modern, energy-efficient buildings, ventilation heat losses reach an order of magnitude of 50% (and more) of the total heat losses of a building. With fan-assisted residential ventilation systems, various options are available to reduce ventilation heat losses, with a focus on heat recovery with the greatest potential for energy savings.

2. When evaluating the energy of heat recovery, the large number of characteristic values used and their poor comparability cause difficulties for both laymen and experts. This can be remedied by an equivalent coefficient of performance of heat recovery that is directly comparable to the characteristic value of heat pumps. For typical conditions, the equivalent coefficient of performance of heat recovery is about 11 to 25, the coefficient of performance of heat pumps is about 3 to 6 (Figure 1). The highest equivalent coefficients of performance are achieved at low outside temperatures, which makes heat recovery a natural complementary system of heat pumps and contributes to relieving the power grid, especially in the dark and windless winter period (dark doldrums).

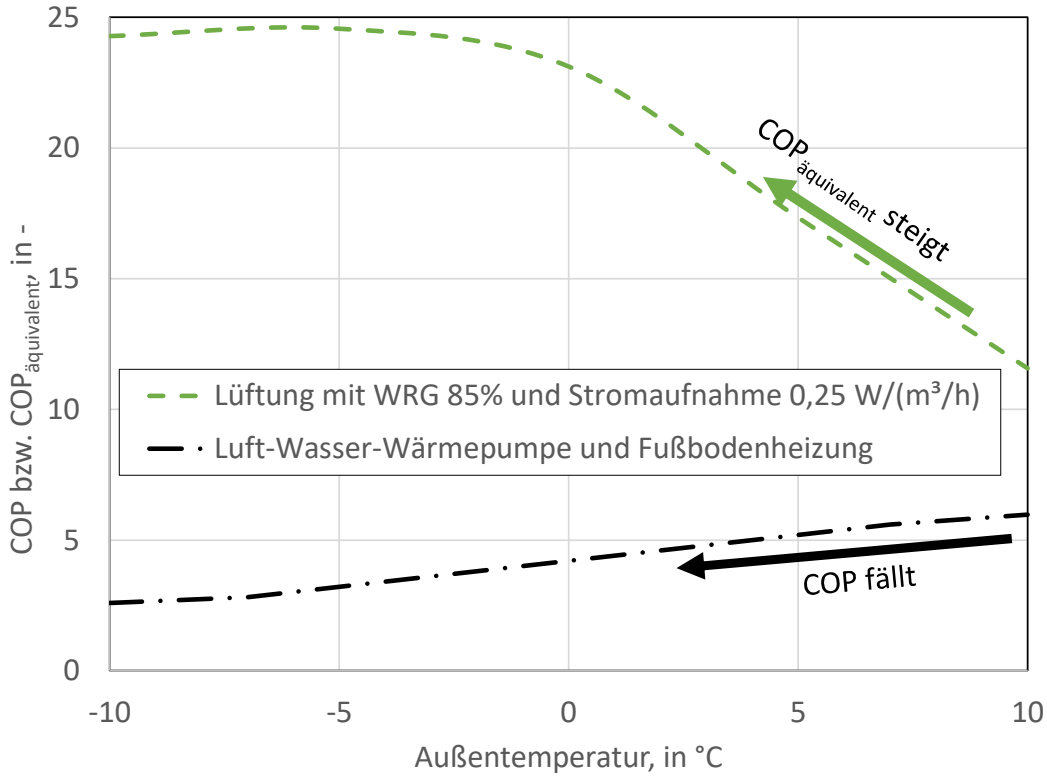

Figure 1: Comparison of equivalent coefficients of performance of heat recovery with Coefficients of performance COP of heat pumps

3. It is only through fan-assisted ventilation with heat recovery that savings can be achieved in terms of ventilation heat losses, which are becoming increasingly important in modern, high-density buildings, and thus the heating load and investment costs for heating technology, without endangering health and building protection (Figure 2). An extrapolation to the total living space in Germany shows a reduction in the network load of 4 to 9.8 GW in the dark doldrums even if half of all apartments are equipped with heat recovery.

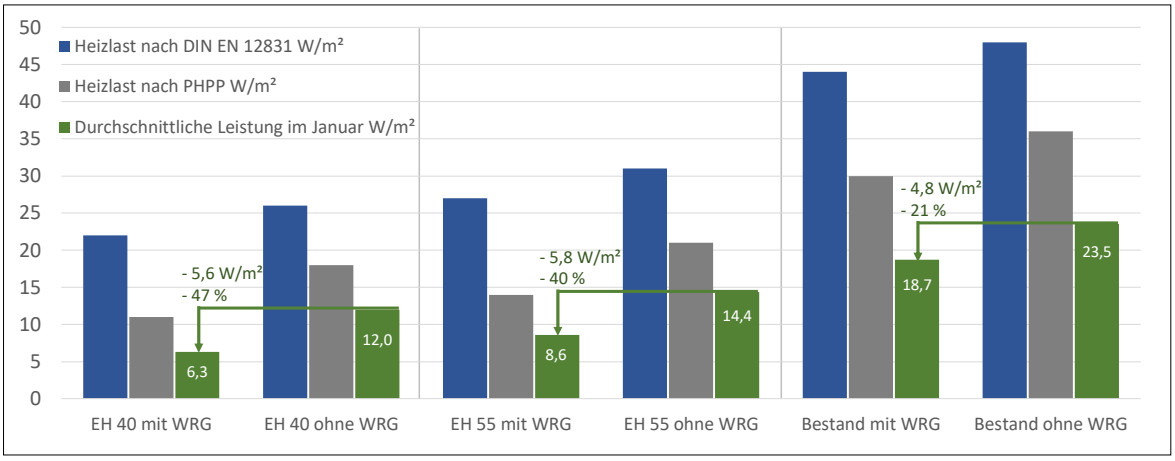

Figure 2: Comparison of the heating load of calculations according to DIN EN 12831 and Passive House Project Planning (PHPP) as well as the average performance in January using the example of a Multi-family house with 1200 m² living space and 18 residential units (Source: Schulze Darup 2022)

4. There are no physically justified arguments to treat waste heat recovery (and thus also heat recovery with ventilation systems) as a "2nd class option" compared to the use of renewable energy. As a rule, the reuse of heat that is already in the building will even be associated with efficiency advantages compared to the use of renewable energy from the environment (Figure 3). Since the use of waste heat through heat recovery can significantly reduce the energy demand for building heating and thus improve energy efficiency on site, their potential in meeting the energy efficiency of the heat demand of buildings should be taken into account in future policy requirements on an equal footing with other measures such as the use of renewable energies.

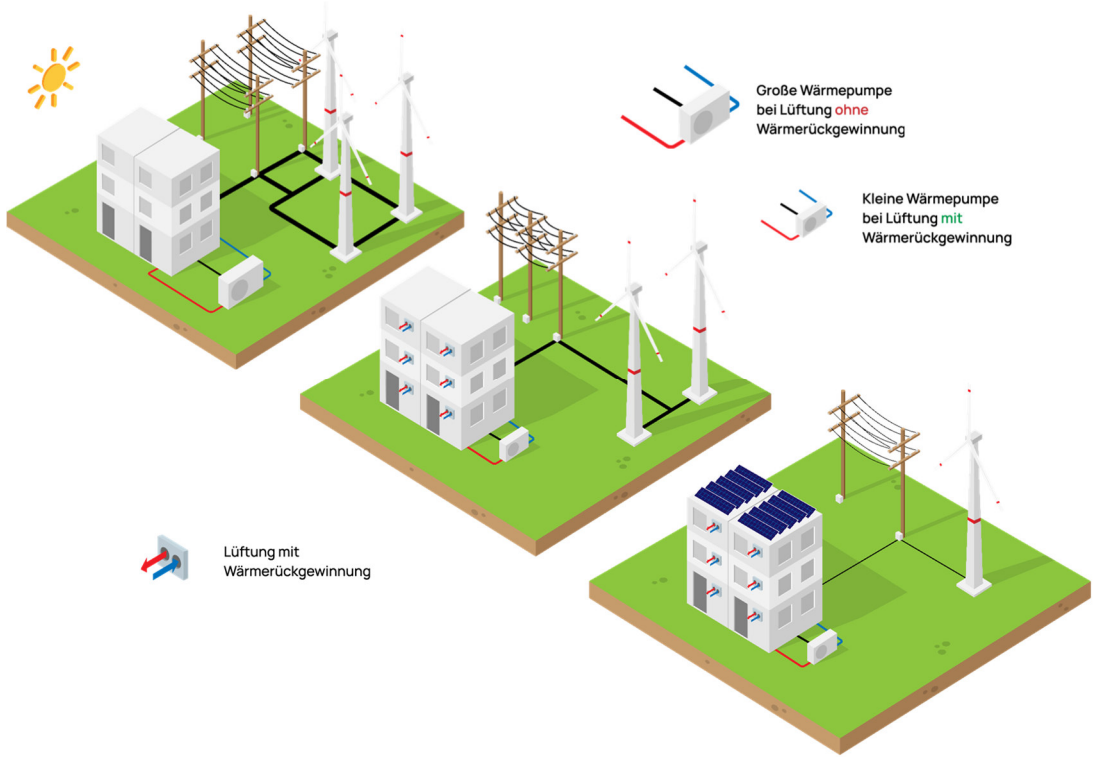

Figure 3: Contribution of heat recovery (heat recovery) to the efficient energy supply of buildings (top left: without heat recovery / middle: with heat recovery / bottom right: with heat recovery and PV)

5. From the point of view of all market participants, a large number of factors such as affordable warm rents, CO2 savings, relief of the electricity and heating networks, the sensible combination with heat pumps and PV systems as well as the absence of structural damage speak in favour of fan-assisted residential ventilation. But also "soft factors" such as high comfort, indoor air quality and health with the avoidance of consequential costs for damage restoration and in the health care system are important for acceptance. Practical planning is about finding a ventilation system that combines as many positive features as possible. In particular, the comparison of window ventilation can provide important pointers here.

Politics	Housing industry	Inhabitant	Housebuilder	Industry
+ Affordable rents + CO_2 savings + Reduced grid expansion (heat and electricity) + Saving fossil fuels + Less energy dependence on foreign countries + lower gross electricity consumption + Complementary product heat pump, bridging dark doldrums + Combination with PV with grid relief	+ Affordable rents + CO_2 savings with Cost savings (step-by-step model) + Protection of the building fabric + Tenant satisfaction + Complementary product heat pump + Combination with PV with increased self-use	+ Heating cost savings + healthy living environment + Mold prevention	+ Protection of the building fabric + Easy installation in new buildings and buildings	+ Growth and jobs + Know-How in Deutschland