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INTEGRAL PLANNING OF BUILDING TECHNOLOGY

Minimal overall cost of investments

Minimal energy requirements

sys kon_4.0

A milestone in energy recovery

The new syskon 4.0 software platform provides an ability to fully utilize recent advances in computing power. With the syskon 4.0 software, it is now possible to extend the analysis of Energy recovery systems (ERS) to include the optimization of not only the ERS elements, but to also improve the efficiency and effectiveness of the primary ventilation, heating and air conditioning systems. With syskon 4.0 the ERS can become an integral component of building technology as a whole. The goal of each syskon 4.0 design is to improve building efficiency, while also positively impacting financial and operational aspects of a building's HVAC systems.

INTEGRAL PLANNING OF BUILDING TECHNOLOGY WITH syskon_4.0

Energy recovery (ERS) not only reduces annual energy consumption, but also reduces peak heating and cooling demand, which in many cases, can help to lower HVAC investment requirements while delivering significant annual energy cost savings over the life of the system.

Integral planning of a building's HVAC systems as a whole is necessary – that is to say, the relationship between the ERS and the ventilation, heating and cooling systems needs to be taken into account during the initial stage of the design and planning process, in order to fully realize the energy savings and investment cost benefits.

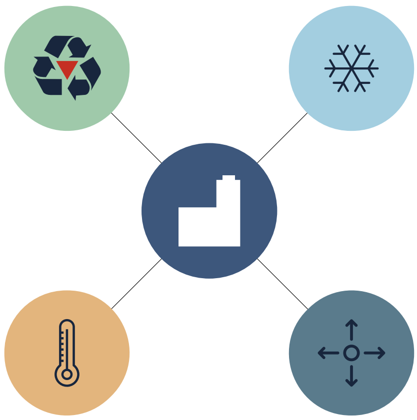
Each syskon_4.0 analysis includes a detailed calculation to determine the ratio of energy recovered by the ERS in relation to any additional ventilation or pumping energy required.

MINIMAL TOTAL COST OF INVESTMENT FOR BUILDING TECHNOLOGY

Integral planning of building technology makes it possible to take into account the effects, in terms of energy and finance, of an ERS on other HVAC systems:

ERS
Reduced peak demand for heating and cooling systems, including recooling

Refrigeration system including recooling
Including hydraulic pumping and piping, water treatment, refrigerant evacuation and electrical service needs



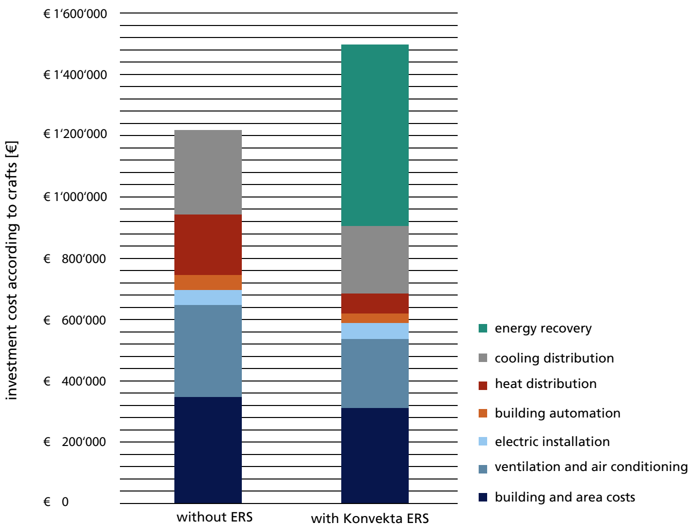
Heating
Including chimney systems, flue gas purification and remote heating connections

Construction measures
Like structural, sound protection measures and spatial requirements associated with HVAC equipment

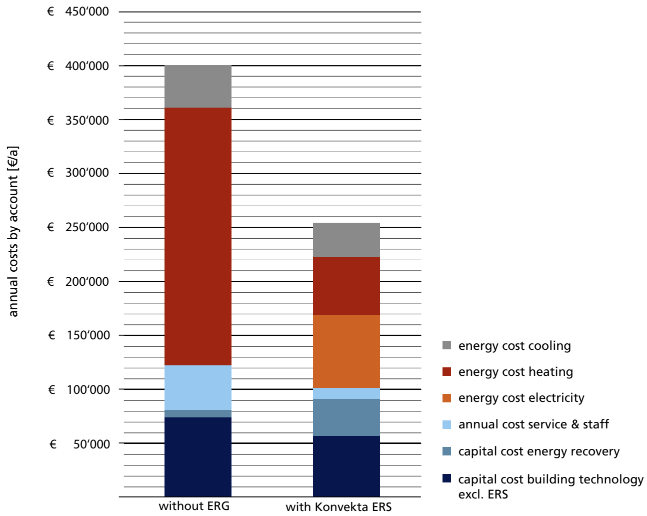
Useful energy*			**without ERS**	**with Konvekta ERS**	**Improvement**
	Heating requirements	[kWh/a]	2'843'900	623'000	78%
	Cooling requirements	[kWh/a]	602'100	495'700	18%
Peak output			**without ERS**	**with Konvekta ERS**	**Improvement**
	Peak heating demand	[kW]	1'269	447	65%
	Peak cooling demand	[kW]	782	549	30%
CO_2 emissions			**without ERS**	**with Konvekta ERS**	**Improvement**
	CO_2 emissions when operating	[kg/a]	1'308'800	599'100	54%
Initial investments			**without ERS**	**with Konvekta ERS**	**Difference**
	Investment costs for building technology including energy recovery	[€]	1'219'700	1'494'100	274'400
	Annual energy costs for electricity, heating and cooling	[€/a]	318'900	154'800	164'100
	Amortisation period	[a]		1.7	
Syskon_4.0 determines the overall investment costs for important parts of the building technology with and without ERS					

*Example: Basic system 100'000m^3/h, dehumidification to 10g/kg, temp. SA summer 18°C, temp. SA winter 22°C, Frankfurt a. M. DE

building techology capital cost



capital and operating costs

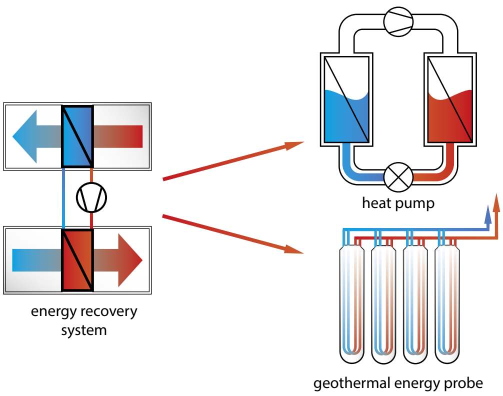


Thanks to the peak heating and cooling demand savings provided by the ERS, both the size and cost of the primary heating and cooling systems can be significantly reduced. Accounting for these cost savings, often results in an exceptionally short financial payback of the ERS investment.

Also thanks to the ERS, the **annual operating costs** can be sharply reduced, resulting in greater economic efficiency.

Geothermal heat pump system

In the case of heat pumps, the savings in primary heating and cooling system costs resulting from the application of a high efficiency ERS (> 75%), is often greater than the initial cost of the ERS itself. The net outcome, is an ERS investment that is cash flow positive from the first day of operation, and which delivers significant annual utility savings over the life of the system.



Exhaust coil frost bypass control

An essential element in maintaining performance of the ERS during periods of low outdoor ambient conditions, is an ability to assure any condensation that occurs at the exhaust air coil does not freeze. Both the initial ERS design and optimization are critical factors in achieving peak performance under all operating conditions, including periods where the potential for freezing of exhaust air condensation exists, a period when other systems like heat wheels and air/air plate exchangers typically experience greatly reduced performance levels.

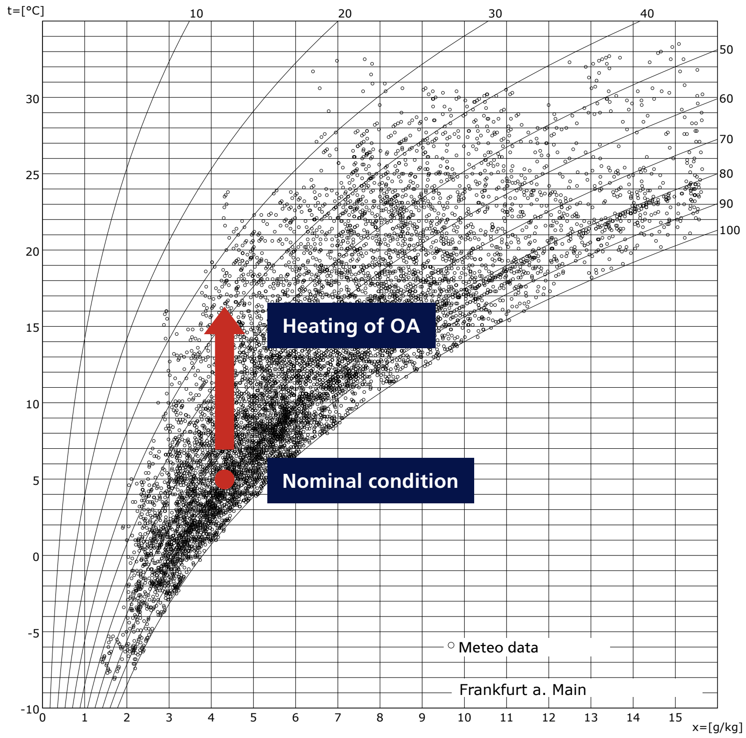
Warranty

The manufacturer of the ERS is responsible for documenting the guaranteed performance levels during the guarantee period, including trending and archival of actual performance data and maintaining a record of all corrective actions or adjustments made as part of the optimization process. Additionally, the ERS manufacturer is responsible for assuring that the ERS has been correctly designed and optimized at all operating conditions.

Syskon_4.0 is able to take into account the primary mechanical equipment, in relation to the ERS, as part of the energy modeling process. This allows for the HVAC equipment to be sized and selected based on the actual heating and cooling requirements, keeping the overall HVAC system investment costs to a minimum. If only individual components (like ERS coils) are sized in such a way as to minimize the cost, the costs of other HVAC equipment would be extremely likely to rise, resulting in an overall increase of the project costs.

« Syskon_4.0 makes it possible to minimize the initial capital investment costs.»

MINIMAL ENERGY DEMAND FOR HEATING AND COOLING OF THE AMBIENT OUTSIDE AIR



Conventional dimensioning of an ERS

In the past, energy recovery systems were statically sized based on a specific design condition in an effort to maximize the heat recovery efficiency level at the prescribed condition. That is to say, at a single defined operating condition, the ERS achieved an ideal priceperformance ratio.

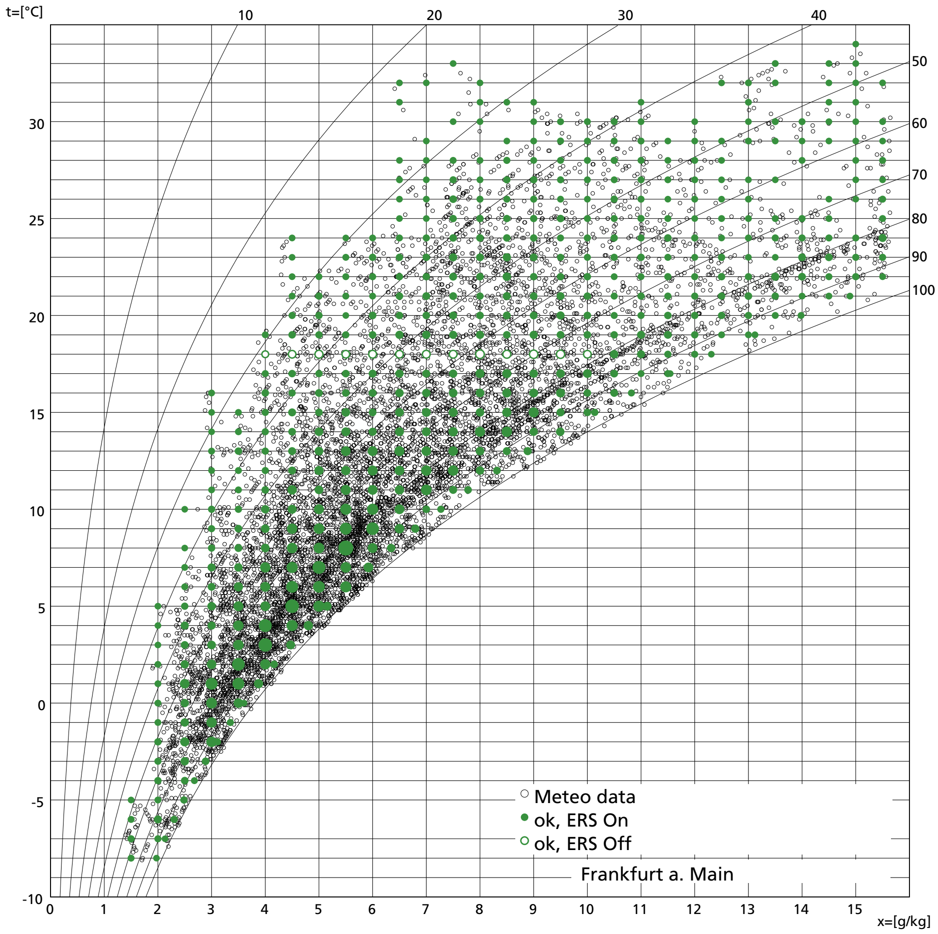
Additionally calculations of ERS performance at the maximum heating and cooling design conditions determined the required coil dimensions and pump size. This static dimensioning for just one operating level has serious flaws.

Unfortunately, this static design approach did not account for the majority of operating hours, and resulted in systems whose optimal performance occurred at only a few hours during the course of a normal year.

- For the dimensioning of the ERS coils, only the heating of the ambient air under nominal conditions was used (outside air temperature 5° C, nominal air flow, no temperature drops below the dew point).
- In the selection and sizing of the ERS coils and pumping systems, the energy implications of cooling and dehumidification processes as well as variable air flow were not taken into account.

« When an ERS is designed based on a single operating point (under nominal conditions), the performance at all other operating conditions is left unaccounted for. The performance of the ERS coils and pumping systems can as a result, be well below an optimal level.»

> « With ERS exchangers of identical dimensions, i.e. with the same investment costs, it is possible to reach a very much higher level of energy efficiency. »



Graphical output of the performance of the ERS over the entire operating spectrum.

New software generation: Syskon_4.0

Syskon_4.0 calculates the performance of the ERS over the entire operating spectrum, from the minimum ambient temperature in winter to maximum ambient air conditions in summer (taking both temperature and humidity into account), in both the full load and partial load conditions. The syskon_4.0 software is able to simulate performance using available meteorological data from the city or region where he ERS will be installed.

The graphical output from the syskon_4.0 simulation highlights all operating points where performance is less than optimal (red rather than green dots on the h-x diagram). The syskon_4.0 design engineers are able to easily run additional simulations, using insight from the graphical feedback. The objective of the syskon_4.0 design process is to achieve the best outcome based on identified project objectives, such as return on investment, maximum peak demand reductions or highest level of carbon footprint offsets.

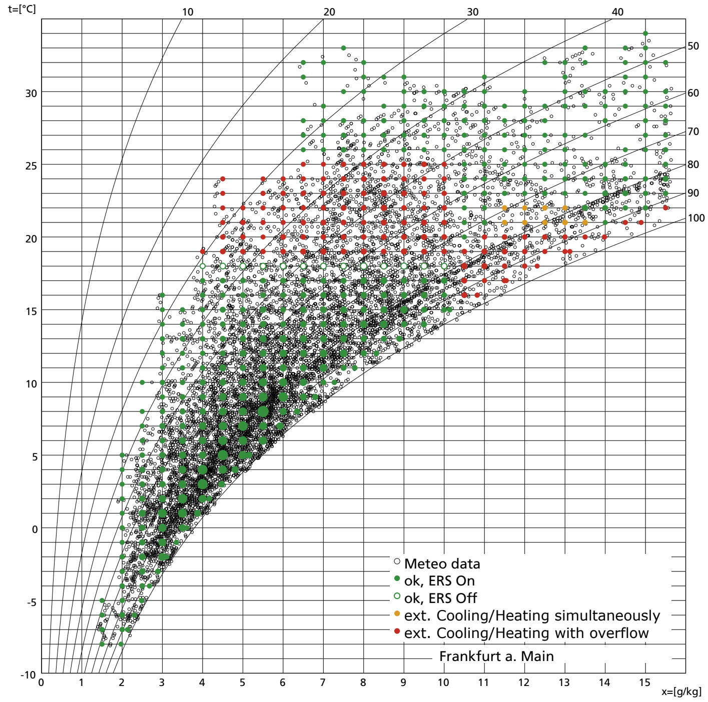
Syskon 4.0 is also able to account for the effect of variable air flow, as part of the performance analysis, in addition to modeling the potential benefits associated with design options such as free cooling, mechanical systems heat rejection, adiabatic evaporative cooling of the exhaust air, and dehumidification strategies.

Thanks to an ability to include multiple HVAC system components in the analysis, syskon_4.0 energy optimization includes not only the efficiency of the ERS, but also takes into account the performance of the central heating and cooling equipment, including heat rejection components such as cooling towers or condensing units.

Example: ERS with less than ideal functionality

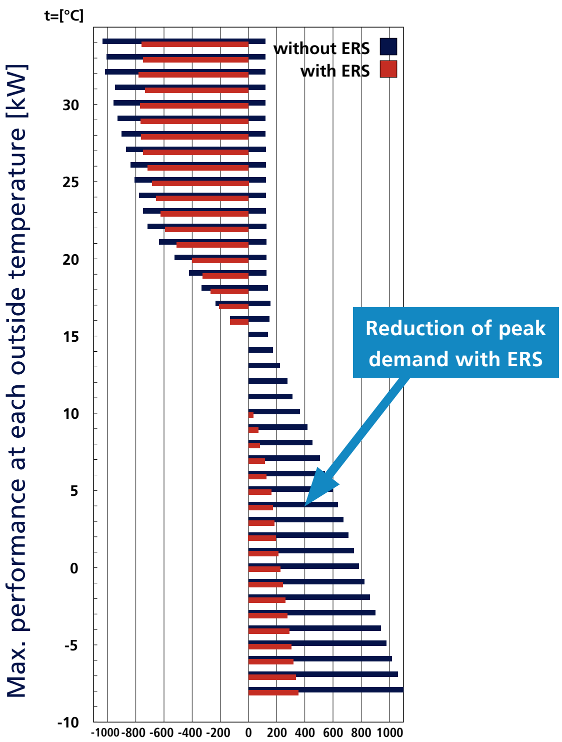
ERS only dimensioned in accordance with nominal conditions

Without optimisation that covers the entire operating range, in transitional periods many operating hours can result at which the energy recovery system will not function as effectively as it should (red dots). If these less than optimal operating conditions are not identified, the necessary design adjustments are not possible.

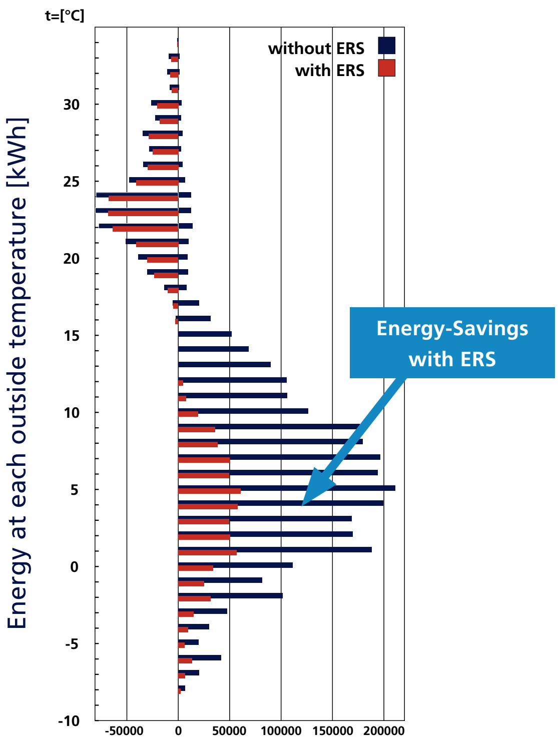


ERS with ideal functionality

(ERS in summer, with cooling / dehumidification and after-heating)



Peak demand for heat generation can be reduced by 65%. The reduction in peak cooling system demand with the heat rejection option is 30%.



The energy requirement for heating can be reduced by 78%, while the reduction in the cooling system demand including with a heat rejection option is 18%

Remark: Sample as per page 3.

Syskon_4.0 calculates the annual energy demand for heating and cooling of the ambient air, as well as the energy recovered and electrical fan or pump energy requirements, to a high degree of accuracy. It does this by taking into account the specific properties of the ventilation and air conditioning systems, such as:

- heating, cooling, dehumidification and re-heating of the supply
- compound energy recovery systems
- adiabatic exhaust air humidification
- supply air humidification
- free cooling/use of waste heat
- mechanical systems heat rejection
- etc.

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