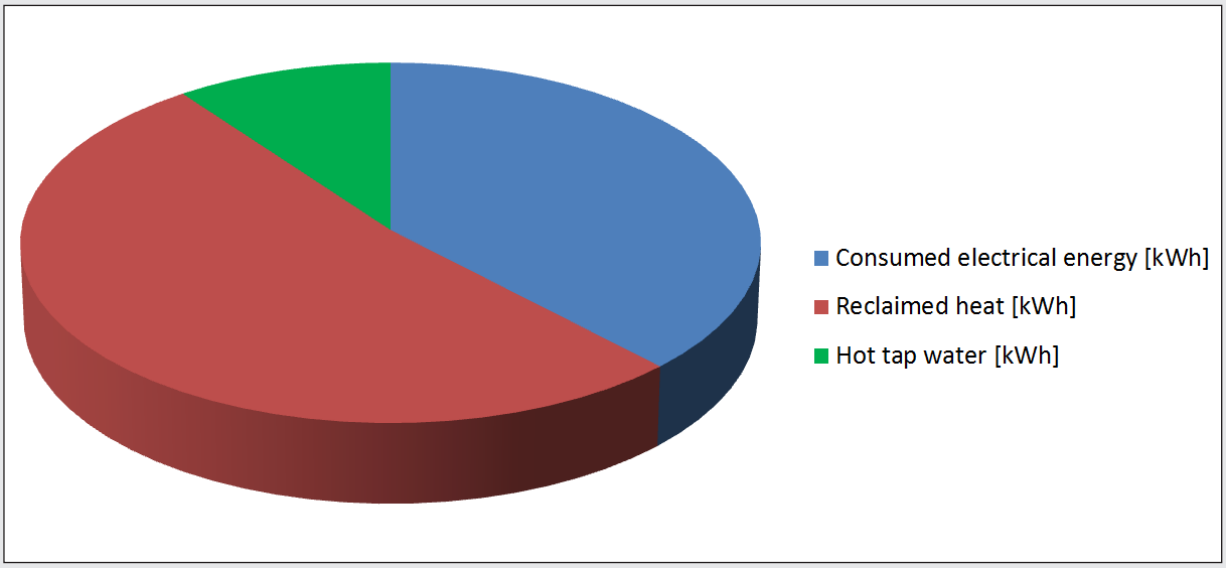
White Paper

Saving money on Heat Recovery

Tested in two different supermarkets



In the new Danfoss pack controllers for controlling compressors, it is now possible to use a specific heat recovery function. For CO_2 applications, it can be shown that it is possible to reclaim all heat necessary in the supermarket, and thus save all energy costs on heating.

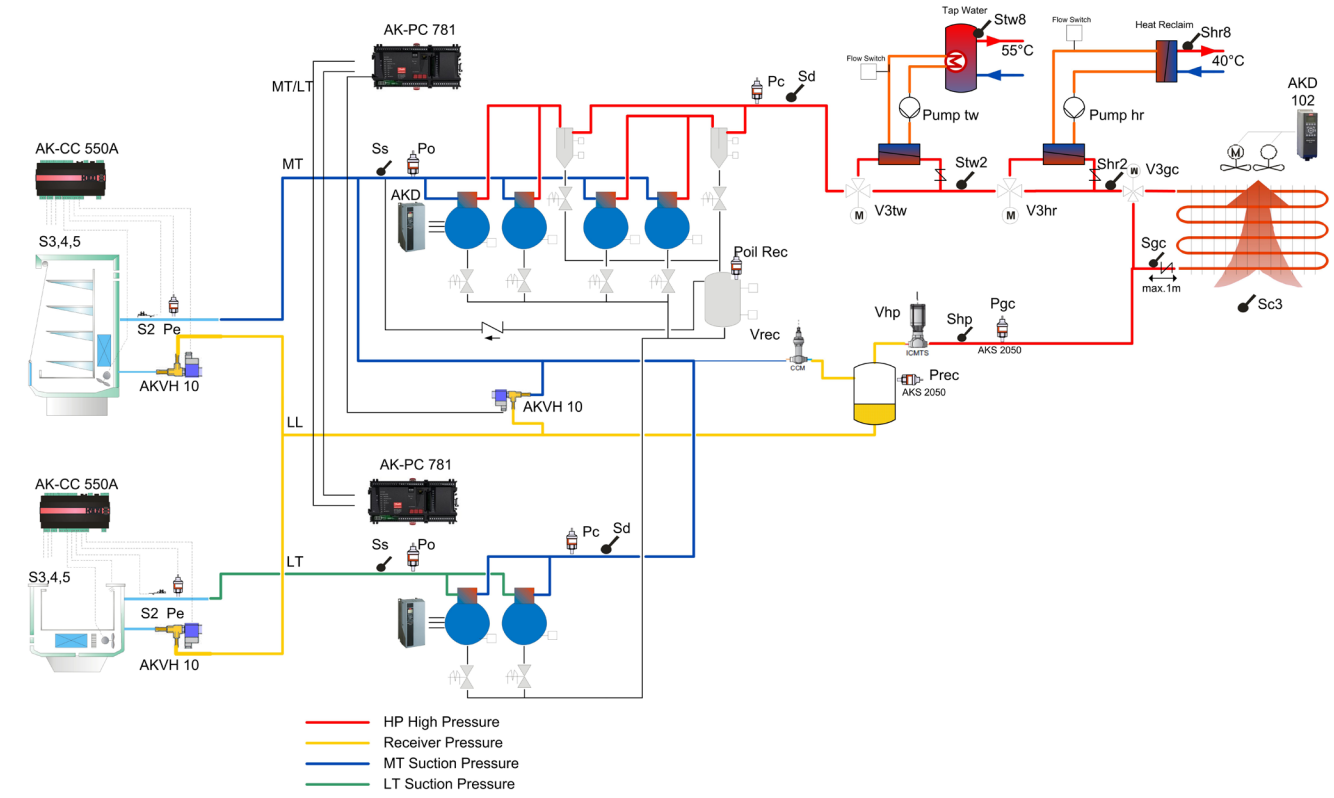
Heat recovery Control and savings

In the new series of pack controllers, it is now possible to use two new functions and reclaim heat for hot tap water and general heat recovery. This has been tested in two different locations, and the pack controller with heat recovery, is now installed in many places throughout Europe.

In both test locations, data has been collected for several months and the conclusion is that it is possible to obtain savings up to 25.000€ pr. Year for a mid-sized supermarket.

System design:

The system is a transcritial CO_2 booster system with hot tap water and heat recovery. This is a traditional system where the gas cooler controller is integrated into the pack controller.



Principal layout of refrigeration plant on both test sites.

Test site 1

- 1000 m² supermarket (Mid-size in Denmark)
- 5 MT compressors and 4 LT, speed on first MT compressor
- Hot tap water tank is 1800 l, reference temperature for the tank is 65°C, the water is used also for cleaning once a day. It takes approximately 2-3 hours to recharge the entire tank from 8°C to 65°C.
- The heating system was changed during the logging period to low temperature supply coils.
- Investment in heat recovery equipment (Two heat exchangers plus some tubing) is less than 7000€.

Test site 2

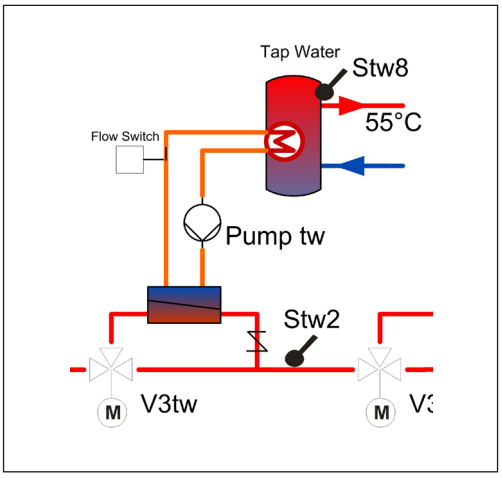
- 700 m² supermarket (refrigerated part is quite small)
- 3 MT compressors, 2 LT compressors, speed on first MT compressor
- Hot tap water tank is 150 l, reference temperature for the tank is 60°C.
- Investment in heat recovery equipment (Two heat exchangers plus some tubing) is less than 3000€.
- The heat exchanger for tap water is very small, but so is the real power consumption for refrigeration due to the fact, that the number of display cases is small, and that the consumption of hot tap water is limited to hand wash.

Hot tap water

Due to legislation it is necessary to divide tap water from the water system exposed to refrigerant if the heat exchanger leaks.

The system provides hot tap water, and for one of the supermarkets the water is used for cleaning of the bakery and butchers departments.
The water receiver in this supermarket contains 1800 l, and is heated to 65°C. When emptied it takes around 2-3 hours before it reaches 65°C again, depending on the gas pressure. If the gas pressure is high, the heating time is low.

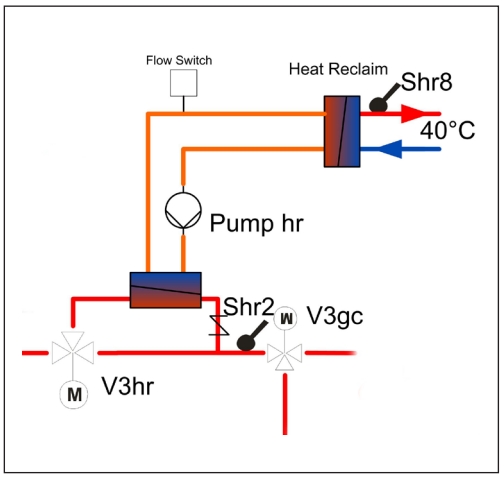
The other supermarket has a water heater with 150 l, and this is maintained at 55-65°C, with short heating times.



General Heat recovery

For the general heat recovery systems, both supermarkets do have a sensor in the shop, that can increase the necessary heat supply by increasing the gas pressure, if the heat demand in the shop increases. For one of the supermarkets, 3 sensors in three different locations each provide a 0-10V signal into the controller which then uses the highest value as input to the heat recovery system.

Both supermarkets do have a combination of floor heating, fan coils and radiators. It is necessary to point out, that radiators are not a suitable heat supply, since the reclaimed heat can generate water at temperatures of 40-45°C.



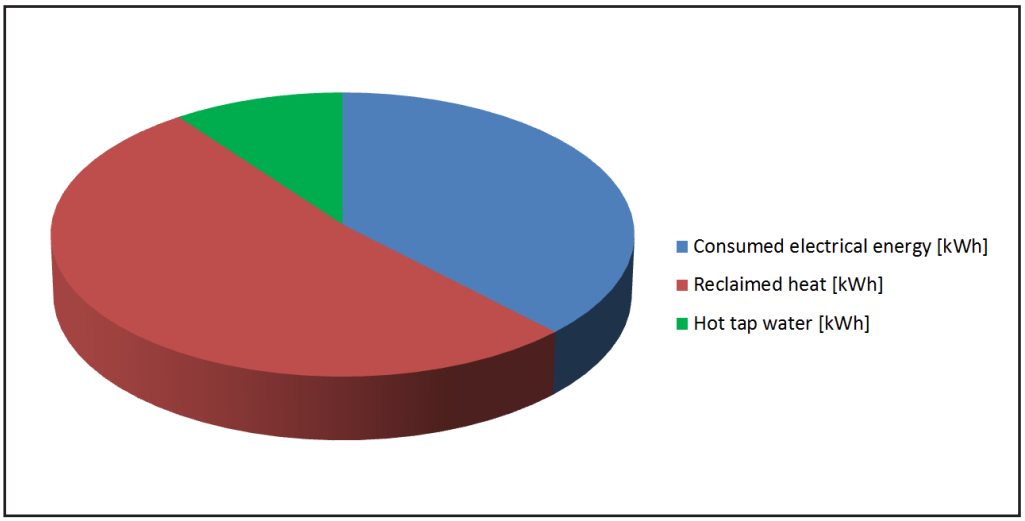
Logging of data

All relevant data including measurement of consumed power and reclaimed energy has been logged for more than 6 months, and is ongoing.

Available energy

For both test sites the available energy is close to 1.3 times the consumed electrical power. Common for both test sites is also that neither use all available heat. The gas cooler (condenser) is still in function, because even at Tambient = -20°C, it is possible to fulfill the heat demand without additional energy supply.

For these two test sites it has been possible to reclaim approximately 40 kWh per degree day.



Conclusion

Test site 1
The savings in energy is measured to be between 100€ -> 130€ per day.
This can be up to 25600 € per year.

And the savings is depending upon the number of degree days. Not all heat is reclaimed.

Simple payback time for the system is less than 5 months.

Test site 2
The savings in energy is measured to be between 15 € -> 25€ per day.
This can be up to 4500€ per year

And the savings is depending upon the number of degree days.
For this site, the heat exchangers for hot tap water and general heat reclaim is very small, and not all available heat is reclaimed.

Simple payback time is less than 1 year for this system

- In super markets where the refrigeration need is of a size where heat recovery is beneficial, it can be shown, that the simple payback time is less than one year. This does require that heat supply equipment inside the supermarket is prepared for low temperature supply.
- Its quite important to secure a proper sized heat exchanger for both hot tap water and general heat reclaim.

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