State of the Art and Need
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Three case studies are described. The first one analysis a sleeve machine, the second one a sensor production chamber and the last one two injection molding companies. Furthermore, a web application tool able to quickly selecting heating devices in terms of power and/or temperature is presented.

The company using the sleeve machine generates a high amount of waste steam. Four concepts were designed to reuse the waste steam. The solutions proposed are preheating the water, recompressing the vapour and using it directly, recompressing the water and using it to boil water, or giving the waste heat to a district heating. The inconvenient with the sleeve machine is that it mixes air and steam, which makes the waste steam not directly reusable. The company chose to sell the waste heat to a district heating which was the most cost-effective solution.

The production steps of the sensors produces a lot of waste heat so that the production rooms need much energy to keep the humidity and temperature under control. Analysis of the electrical and thermal energy consumption of the air handling units for production and clean rooms, measurement of the room temperature and humidity as well as the in- and outlet temperatures of the hot and cold water storages were made. Furthermore, an analysis of the thermal power and operation time of heat pumps was performed. Investigation of the thermal energy consumption for the clean rooms showed that the air-handling unit is heating the incoming air, while at the same time the air conditioning is cooling the room air to keep the room temperature at the desired temperature.

Analysis of the injection molding companies shows that only 3% of heat recovery is achieved, instead of the 70% according to manufacturer indication, and that adding a frequency converter for cooling water pumps could save up to 30% of electric power. Further improvements could also be implemented such as better insulating the hot water pipes in unused spaces and using colder outside air instead of warm room air for the air compressors.

Finally, a web application tool is described. It contains a database of more than 300 heating devices of different types (heat pump, gas turbine, fuel cell, solar panel, and boiler). The tool allows filtering through this database using a standard web browser by giving the temperature and/or the heating power.

Figure 1: A) high-pressure and B) low-pressure evaporation processes to generate steam.

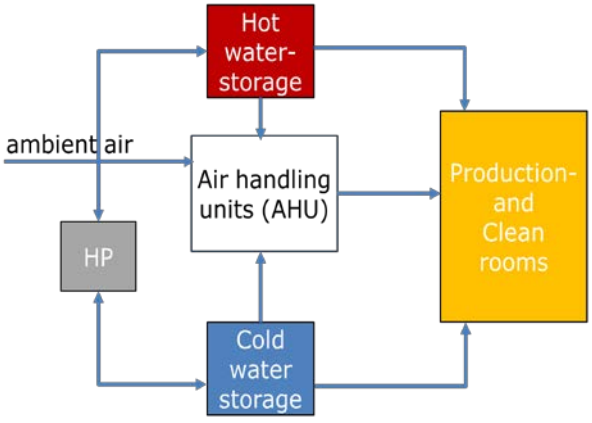

Figure 2: High temperature heat pump demonstrator prototype in construction at NTB Buchs.