



Process heat - heat recovery

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Process heat

- Heat used for technical processes like drying, melting or forging

- Main types of process heat
 - Hot air
 - Warm and hot water
 - Steam
 - Thermo oil

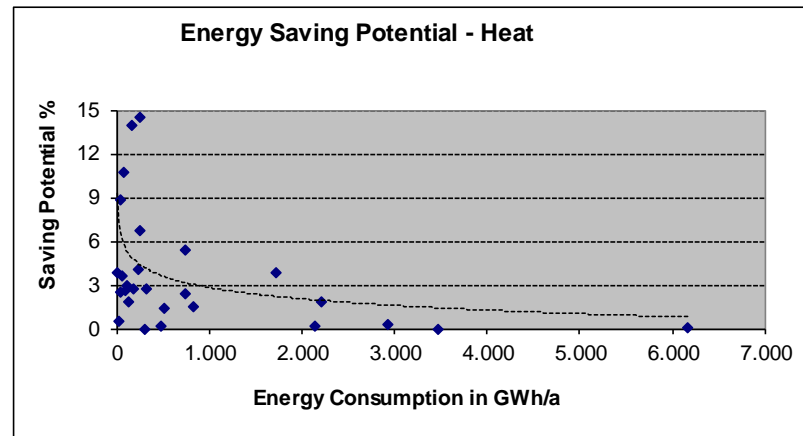
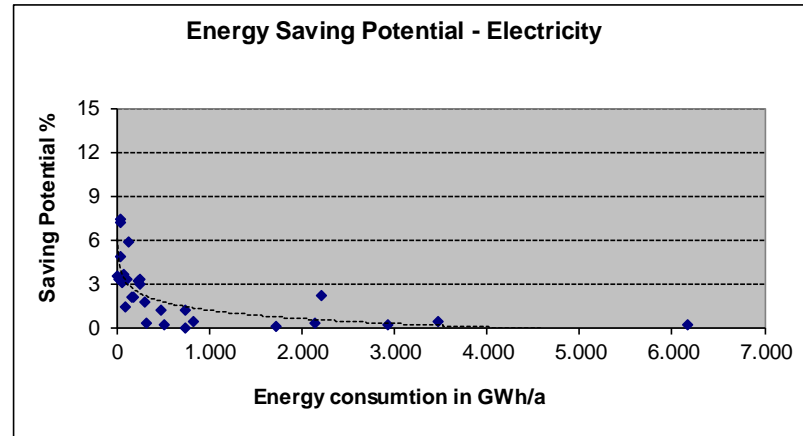
Process heat



- Main parameters for process heat (energy) consumption
 - Level of temperature / pressure required
 - Efficiency of heat generation
 - Minimization of losses (radiation, standby, flue gas and distribution losses)
 - Control (runtime and temperature)
 - Optimization of system
 - Electricity consumption of auxiliaries

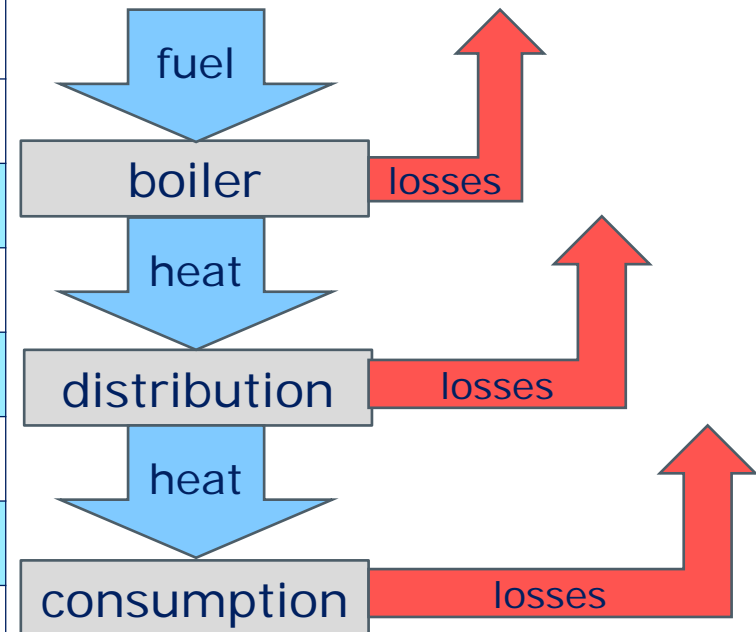
Process heat

- ALLPLAN experiences for energy saving potential in different enterprises (pay back < 3 years). Sample: international clients



Process heat

degree of efficiency η			
		ideal	real
η	generation	99%	75%
		x	
η	distribution	99%	90%
		x	
η	consumption	99%	50%
η	<i>generation</i>	<i>97%</i>	<i>33,8%</i>
		↓	↓
	<i>fuel input</i>	<i>1.031 MWh</i>	<i>2.963 MWh</i>
		↓	↙
	<i>useful heat</i>	<i>1.000 MWh</i>	



Boiler efficiency:

$$\eta_b = \frac{\text{useful heat } Q_N}{\text{fuel input } Q_f}$$

Distribution efficiency:

$$\eta_d = \frac{\text{useful heat } Q_{N,out}}{\text{useful heat } Q_{N,in}}$$

Process heat



■ How to optimize process heat consumption:

1. Avoid unnecessary heat consumption
2. Efficient use of heat in given system
3. New technology / new system



■ Heat recovery

Heat recovery

- Advantages of heat recovery
 - Reduction of connected wattage (kW) for heating and cooling energy
 - Reduction of energy consumption (kWh) for heating and cooling
 - Reduction of dependency on (fossil) energy sources
 - Reduction of risk of (increasing) energy prices
 - Reduction or elimination of boiler, chiller, cooling tower, chimney, etc.
 - Reducing capital and operation costs
 - Reduction of environmental pollution

Heat recovery



- Potential sources of waste heat
 - Motors and engines
 - Cooling devices
 - Ventilation
 - Waste water
 - Compressed air systems
 - Drying processes
 - Manufacturing facilities / processes
 - Flue gas from combustion processes
 - Re-evaporation (flash steam) in steam systems

Heat recovery

■ Example of temperature levels / mediums of waste heat

high- temperature	HT	>200°C	ceramic / steel	>1000°C	flue gas
			roasting	200°C	flue gas
medium- temperature	MT	>100°C	food processing	<120°C	steam / water / thermal oil
			extraction (e.g. soy oil)	<160°C	steam / water / thermal oil
low- temperature	LT	<100°C	washing process	<90°C	steam / water
			galvanic bath	<60°C	water
			photo processing	<40°C	water
			drying		hot air

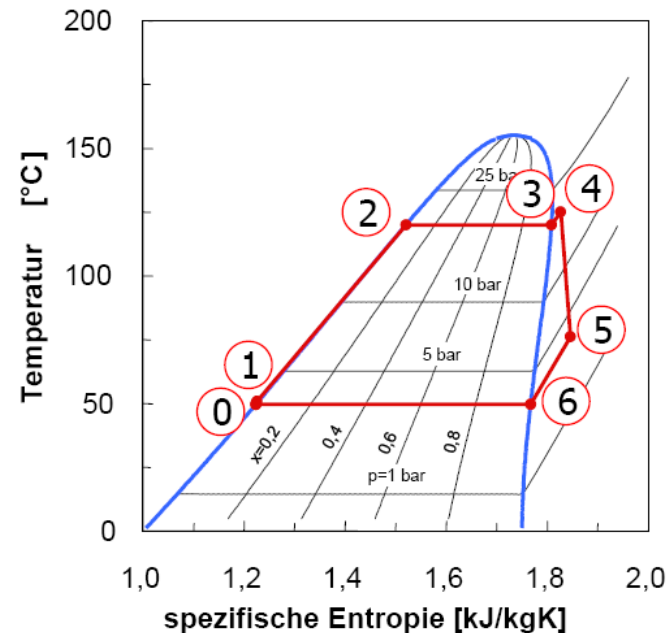
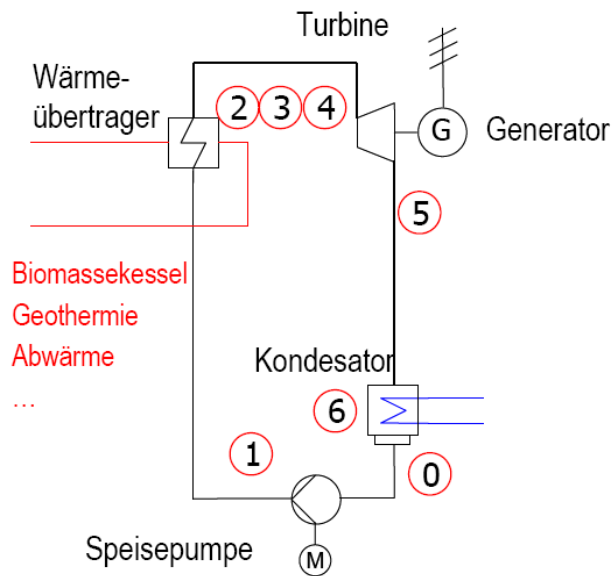
Heat recovery

- Potential heat sinks for waste heat
 - Water heating
 - Space heating
 - Pre-heating
 - Recovery of cooling unit
 - Drying processes
 - Feed into heat grid (e.g. district heating)

Heat recovery

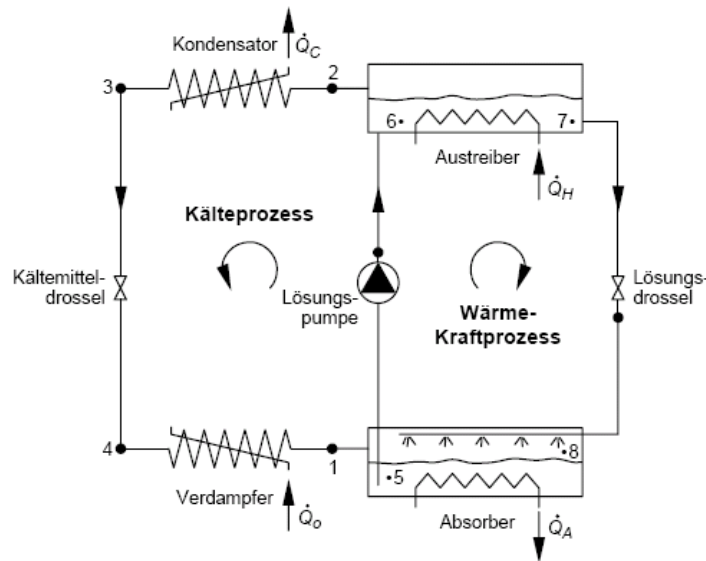
- Other technologies recovering / using waste heat

- ORC - process using medium temperature waste heat for electricity generation

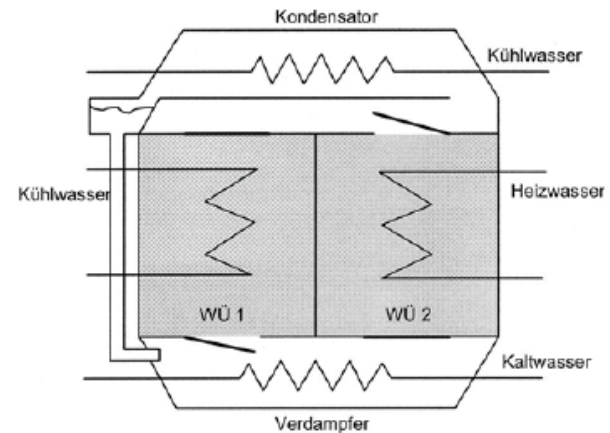


Heat recovery

- Other technologies recovering / using waste heat
 - Cooling through use of waste heat (thermal refrigeration)



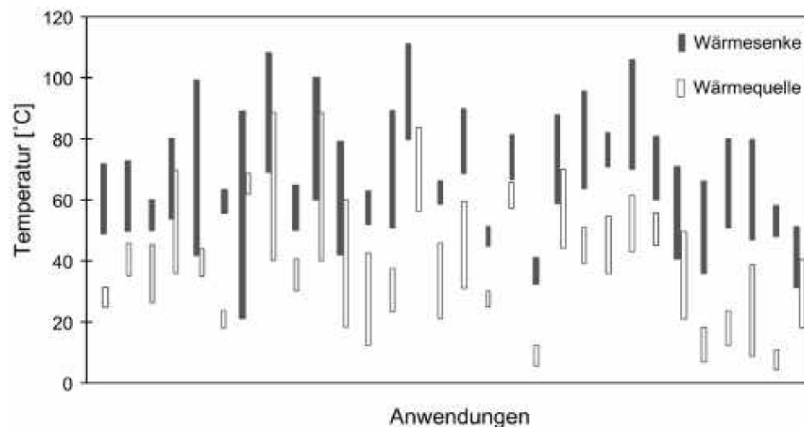
Absorptions refrigeration



Adsorptions refrigeration

Heat recovery

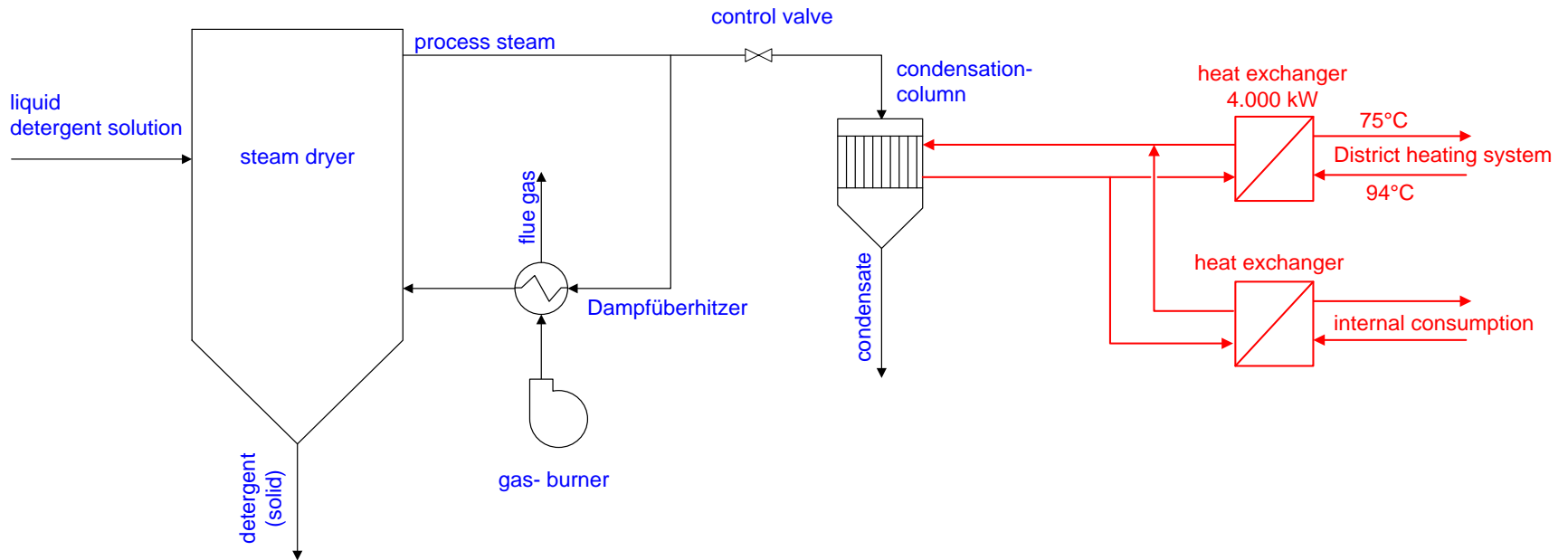
- Other technologies recovering / using waste heat
 - Use of low temperature waste heat via heat pump



Heat pump MA30
sewage plant Blumental

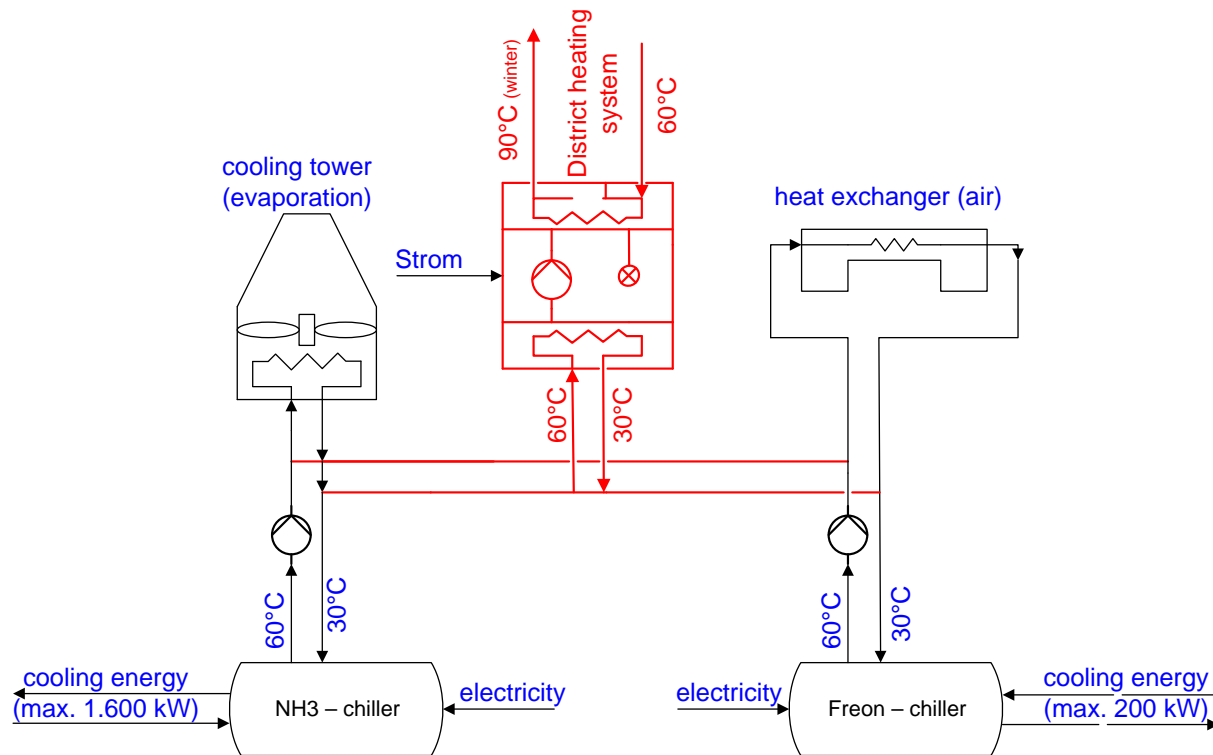
Heat recovery

■ Example for heat recovery concept via heat exchangers



Heat recovery

- Example for heat recovery concept with heat pump



Process heat & Heat recovery



Thank you for your attention!



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