RECP Best Practice Catalogue

Heat pump

Developed within the framework of MED TEST II

July 2018

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

The SwitchMed Programme is funded by the European Union

Best Practice - Heat pump

SECTOR:	**Food & Beverage**
SUBSECTOR:	Processing and preserving of meat and production of meat products
PRODUCTS	Frozen chicken
CATEGORY	Process control or modification
APPLICABILITY	Utilities

COMPANY NAME	---
COMPANY SIZE	Large

Best Practice - Heat pump

Description of the problem (Base scenario):	The company operates a large ammonia refrigeration plant for production. On the basis of the present data, the utilization of the waste heat has been considered with regard to its possible usage. Where refrigeration is operated, waste heat is generated, but this is not available for direct use in this case because the temperature level is too low. Since the heat is to be fed into an existing heating system for hot water production, higher temperature of the waste heat flow is needed.
Description of the solution	If the condensation heat of the central refrigeration system is to be used, usually flow temperatures of up to 35 ° C can be achieved. By using the high-pressure heat pump, a temperature level of 65 ° C - 68 ° C can be achieved. The gas compression of the central refrigeration system for production cool is carried out by three piston compressors at a temperature level of approx. 30 ° C. A waste heat utilization at this temperature level, as already mentioned, is not possible for heating purposes. Therefore, a further compression stage with a separate piston compressor is integrated directly into the refrigeration circuit of the central refrigeration system. By means of this additional compressor, which is integrated in the ammonia circuit, the waste heat is raised to a higher and thus usable temperature level. The ammonia gas from the circle of the central refrigeration system is cooled by + 30 ° C (corresponding to 11.5 bar) to + 70 ° C (corresponding to 33 bar). With these temperatures, outlet temperatures of 66 ° C can be reached at the waste heat condenser. The temperature can then be connected directly to the existing heating system. The special piston compressor can be operated up to 40 bar, which makes it possible to use the high-pressure heat pump to have a safe operation. The waste heat is thus obtained directly from the high-pressure side of the central refrigeration system without a loss-bearing intermediate circuit or heat exchanger. This results in an exemplary energy efficiency of the entire system.

Best Practice - Heat pump

Economic Benefits

Heat Pump
Heat pump output = 1,000 KW , Drive power = 170 KW, COP (1 kW current = 6.0 kW heat) = 6.0 Hours 20 h / day = 6,000 hr/year, Operating hours 6,000 hr/year = 6,000,000 kWh
Electricity costs = 10 ct. / kWh, Heat costs (power demand drive) = 1,000 kW x 6,000 hr/year = 6,000,000 kWh / year
COP = 6.0 = 1,000,000 kWh /year, Heat costs: 1,000,000 x 10 ct. / kWh 100,000 € / year
Revision costs € 10,000 / year
Total € 110,000 / year

Saving on the refrigeration system
When the condenser heat is used in the heating, less additive and Sludge water on the evaporation condenser. In addition, electricity is used for the condenser fan.
Condenser power savings (830 kW) = 4,980,000 kWh/year. The amount of water supplied (3 m^3 / 1,000 kWh) = 14,940 m^3/year, Amount of waste water = 7,470 m^3/year, Total electricity consumption (10 kW) = 60,000 kWh/year

Cost savings at the refrigeration plant
Water costs (1.0 € / m^3) = 14,940 €/year, Electricity costs = 6,000 €/year
Total savings = 39,615 € / year

Cost comparison
Heat output = 6,000,000 kWh/year, Heat costs (3 c.t / kwh / Ho / Hu + boiler efficiency = 70%) = 257,142 €/year, Cost heat pump (electricity) = - 110,000 €/year, Saving refrigeration system = + 39,615 €/year

Total saving = 186,757 € / year

Best Practice - Heat pump

Environmental Benefits	**Energy Saving=** 6,000,000 kWh/year **Reduced CO_2 emission= 1,680 ton/year** **Water saving= 14,940 m^3/year**
Health and safety impact	---
Capital investments & financial indicators	€196,350 Payback period = 1.1 years
Suppliers	Local
Other aspects	------
Implementation	Planned to be implemented when having the needed investment.