PREHEATING WITH A HYBRID HEAT PUMP SECURES LARGE SAVINGS FOR SPRAY DRYING FACILITY

Arla Foods in Videbæk produces milk powder, and the process includes a spray drying facility. Installing a hybrid heat pump made it possible to exploit waste heat. The heat pump has increased system efficiency and has reduced energy consumption considerably.

Arla Foods, Videbæk

PRODUCTION
Milk powder

INITIATIVE
Optimisation of spray drying facility using a hybrid heat pump

RESULT
Total annual energy savings of 15,000 MWh

Economy

16,400 MWh
Annual natural gas savings

15,000 MWh
Annual energy savings

1,406 MWh
Heat pump electricity consumption

1.6 years
Simple pay back period

The result

- Total energy saving of 15,000 MWh

How much did it cost?

The capital investment was DKK 12.5 million (EUR 1.7 million). After energy subsidies, there is a simple payback period of 1.6 years.

Why was the project carried out?

Arla Foods in Videbæk became aware that the evaporation plant preceding the spray drying plant produced waste heat that could be utilised without this affecting capacity or quality.

Heat is recovered from the evaporators' cooling towers and used to preheat injection air for one of the spray towers. The heat is utilised partly through direct exchange and partly through a hybrid heat pump.

How was the project carried out?

The evaporators were originally cooled by cooling towers that released energy to the surroundings. In this project, the cooling tower cooling capacity was replaced by a heat exchanger and a hybrid heat pump producing cooling water at 25 °C via the heat pump desorber. Cooling water is stored in a 100 m^3 buffer tank from where evaporators placed before the spray-drying plant can retrieve the cooling water as required.

The evaporators heat the cooling water to 45 °C, after which it is sent on to a 100 m^3 buffer tank. From the hot buffer tank, the water is sent back to the heat pump desorber or is used for initial preheating of injection air.

The water used for initial preheating of injection air is subsequently sent back to the cold buffer tank. In the event of breakdowns or in connection with servicing, the original cooling tower can bypass the heat pump

to continue production. Furthermore, when electricity is supplied, the hybrid heat pump can produce water at a temperature of 85 °C and this can be used for step-two preheating of injection air.

What were the results of the project?

Water from the hybrid heat pump can raise the injection air temperature to 63 °C, and this reduces the required subsequent temperature increase. Initial heating from 28.5 °C to 33 °C is directly from injection air in a heat exchanger. This process requires only little electricity and therefore represents large savings in electricity consumption.

The energy saving is achieved because the injection air only has to be heated by steam from 63 °C to 225 °C, whereas previously, it had to be heated from 28.5 °C. Savings on natural gas after installing the hybrid heat pump have been calculated at 16,400 MWh.

Heat pump electricity consumption less previous consumption for cooling towers and other equipment is 1,406 MWh. This results in total energy savings of around 15,000 MWh.

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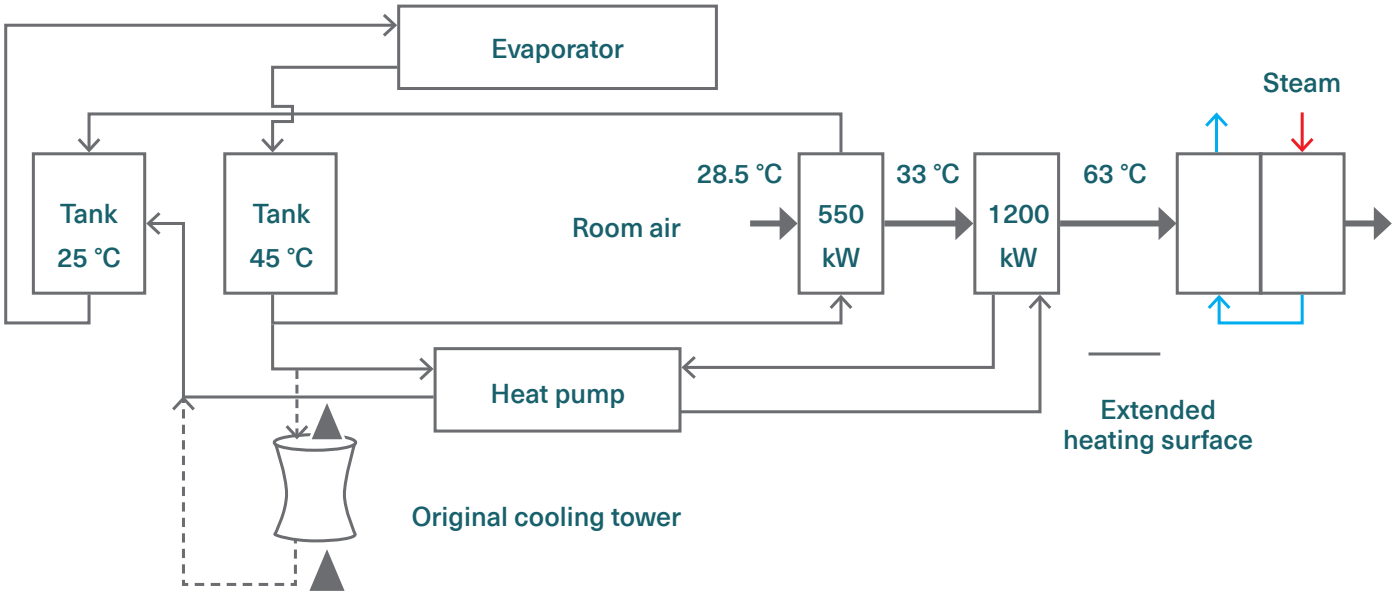
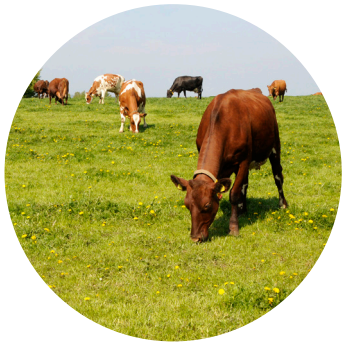


Figure 1: Principle behind utilisation of waste heat from an evaporator for the drying facility



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