RECP Best Practice Catalogue

Increase efficiency for pasteurizers
(Heat Recovery Ratio)
Developed within the framework
of MED TEST II

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

switchmed

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Best Practice - Increase efficiency for pasteurizers (Heat Recovery Ratio)

SECTOR:	**Food & Beverage**
SUBSECTOR:	Manufacture of dairy products
PRODUCTS	UHT Milk products
CATEGORY	Process control or modification
APPLICABILITY	Process

COMPANY NAME	---
COMPANY SIZE	Large

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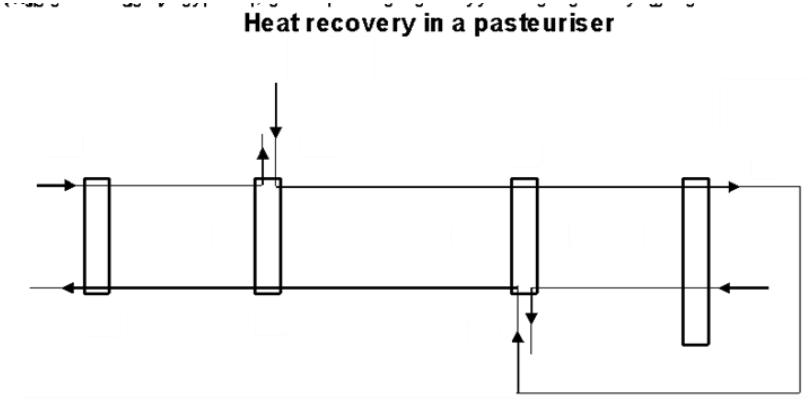
Description of the problem (Base scenario):

The company operates different pasteurizers to serve the different products (one pasteurizer dedicated per each product category). The investigation on the temperature profile for the pasteurizers revealed that the Heat Recovery Ratio (HRR) was far below the best practice. The HRR at this site's pasteurizers was calculated to be 75%, while the best practice is to have HRR up to 95%.

HRR is an indicator to the ratio between the temperature rise in product preheating to the total temperature rise as illustrated in the below figure



HRR% =Heat recovery (or regenerration) Ratio

If all 3 temperatures are given

T_1 = product inlet temperature : IN

T_3 =Product heating temperature (past)

T_2= Regenerative in (to the heater) : R_i

T_4 = Regenerative out (to cooler) : R_o

$$HRR\% = \frac{R_i - IN}{Past - IN}$$

$$= HRR*(Past - IN) + IN$$

$$= Past - HRR*(Past - IN)$$

$$\frac{B - A}{C - A}$$

Example:	A = (IN)	20	°C	45.0	HRR%
	B = (R_i)	65	°C	60.0	75%
	C= Past	80	°C		
	D =(R_o)	C -D=B-A			
		-D=B-A-C	D=C-B+A	35	
	A = (IN)	20		51.0	HRR%
	B = (R_i)	71		60.0	85%
	C= Past	80			

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Description of the solution	**Increasing the HRR to only 85% through adding more plates in the regenerative section of the pasteurizer. The addition of plates will allow more area for heat transfer, thus increase the regenerative temperature from 65 degrees to 71 degrees, reducing the steam needed for heating (decrease boiler load), and water needed for cooling (decrease chiller load).**
Economic Benefits	Energy consumption for heating is calculated as: $Q_{heating}$= mass flow rate x specific heat capacity x temperature addition by steam / boiler efficiency And the cooling is calculated as: $Q_{cooling}$= mass flow rate x specific heat capacity x temperature reduction by chilled water/ chiller efficiency Energy savings was calculated to be 4,541,807 kWh/year, equivalent to 120,552 Euro/year
Environmental Benefits	Reduction in energy consumption by 15.95 kWh/ton With an annual production of 284,832 ton/year = 4,541,807 kWh/year (28.2% of the baseline). CO_2 reduction associated with the energy savings is equivalent to 1,528 ton/year

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Capital investments & financial indicators	Cost of increasing the regenerative cross section area through adding plates (to be designed by the pasteurizer supplier) to three pasteurizers is 103,535 Euro Payback is 0.86 years
Suppliers	Original pasteurizer supplier
Other aspects	The investment cost varies according to the design of the heat exchanger (plate heat exchanger or tube heat exchanger), where it is cheaper to implement for plate heat exchangers. In case the cooling water, or steam is an open circuit (not 100% recirculating), there shall be savings in water as well.
Implementation	The measure was retained for study due to the high investment cost.

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Replicability sectors	The same concept can be replicated in • Dairy industry
Aspects to investigate for replicability	Temperature profile of pasteurization Heat Recovery Ratio Type of pasteurizer (plate heat exchanger or tubular heat exchanger) Treated volume Efficiency of boiler and cooling system (chiller)
Useful resources	