How to lower the carbon footprint of the process room

Presentation at DMS seminar “Framtidens teknologier i skummesalen”

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Agenda

- What factors will influence carbon footprint
- Regeneration definition
- Running time
- Product losses
- Cleaning
- Relation between regeneration and carbon footprint

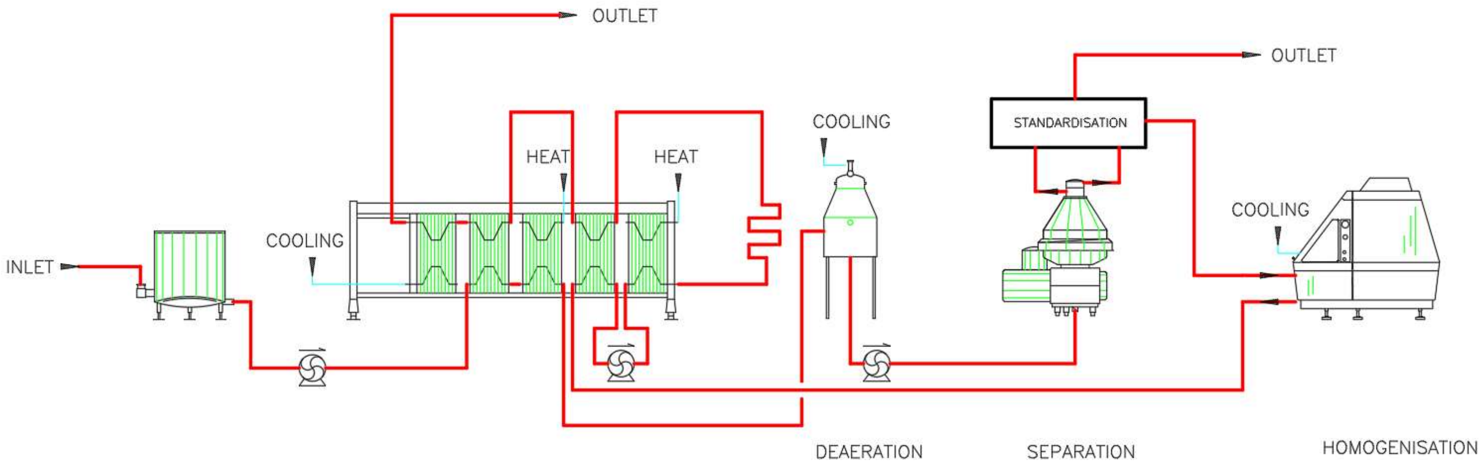
Disclaimer
All figures are for guidance only

What factors will influence carbon footprint from process room

Carbon foot print in process room

What factors will influence the carbon footprint

Pasteuriser



Heating media

Cooling media

Pressure drop

Machine efficiency

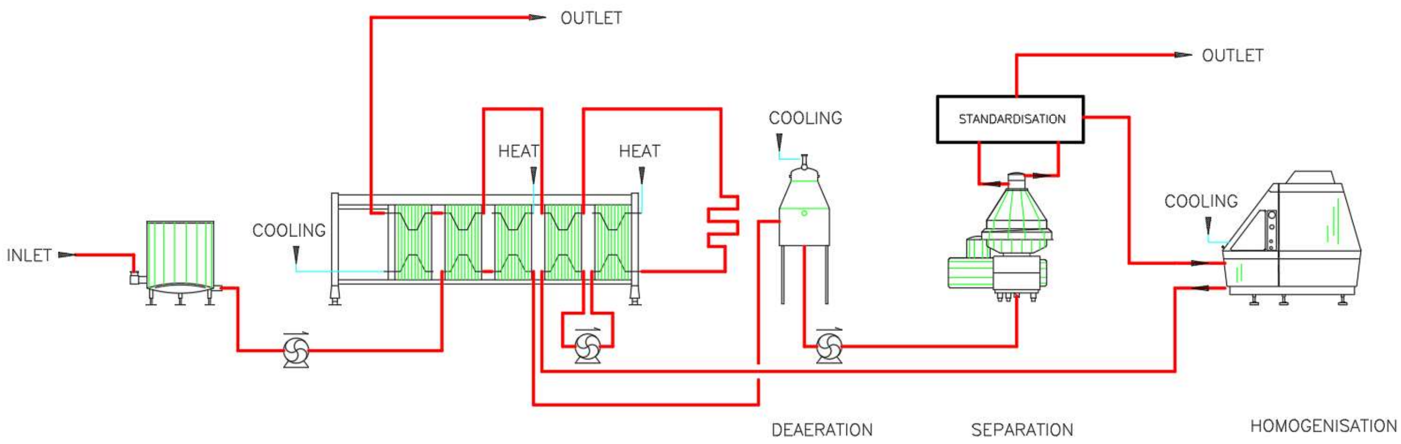
Running time

Cleaning

Product losses

Energy usage in pasteuriser

Power during production – 10.000 l/h pasteuriser (90% regen)



Heating – 80 kW

Cooling – 80 kW

Deaeration – 50 kW

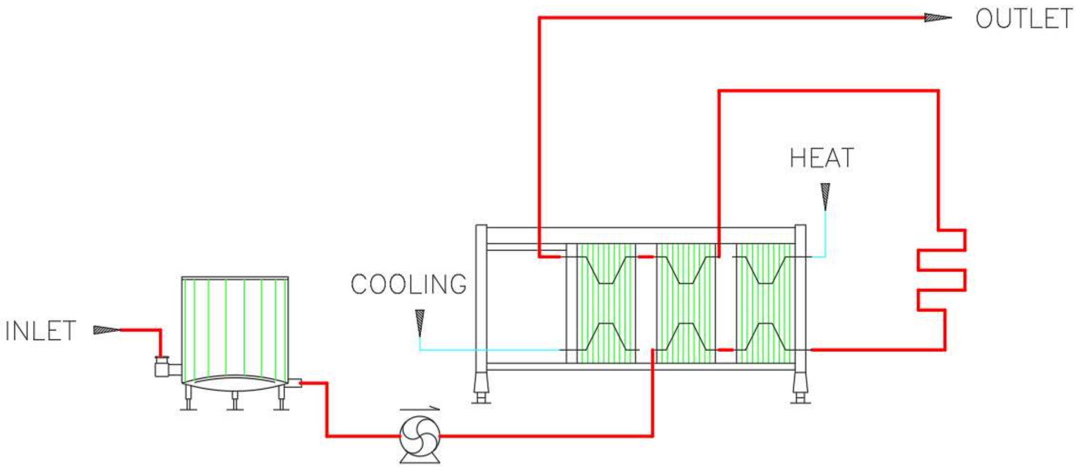
Separation – 10 kW

Homogenisation – 50 kW

Pumps - 5 kW

Some carbon footprint factors

Steel	1 kg steel – 2 kg CO_2
Product loss	1 kg milk – 1,5 - 3 kg CO_2
Heat	1 kWh – 0,3 kg CO_2 (Coal/oil)
Electric power	1 kWh – 0,7 kg CO_2 (Denmark)
Cooling	1 kWh – 0,2 kg CO_2



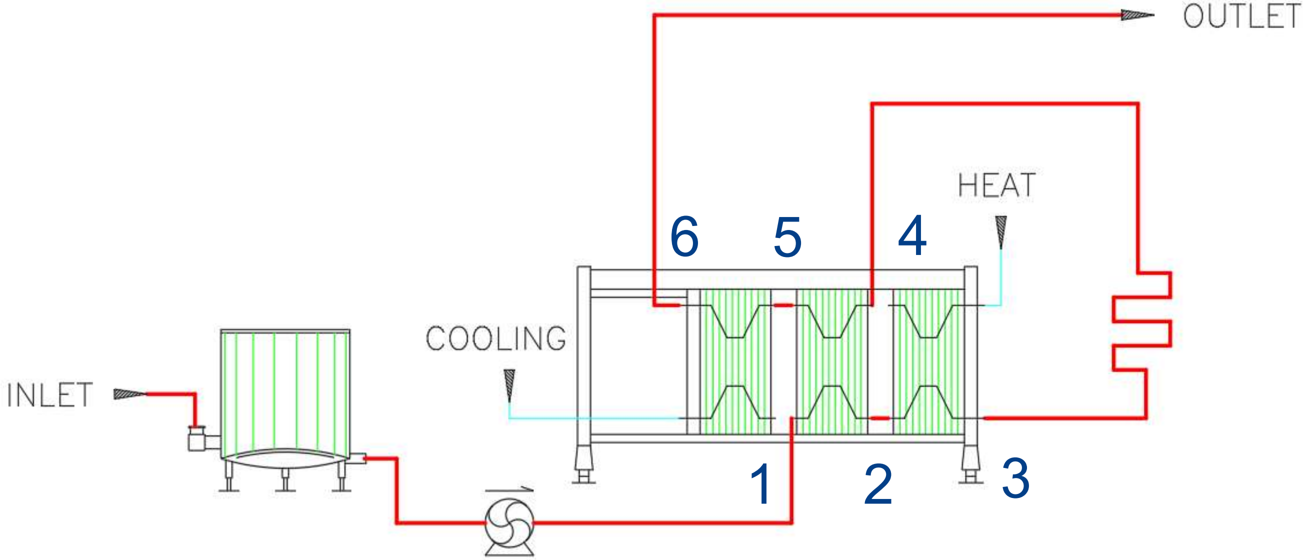
Regeneration

Carbon foot print in process room

Definition of regeneration degree

$$\text{Regeneration degree} = \frac{T2 - T1}{T3 - T1} = \frac{T4 - T5}{T4 - T6}$$

”Regen”



Pasteuriser running times

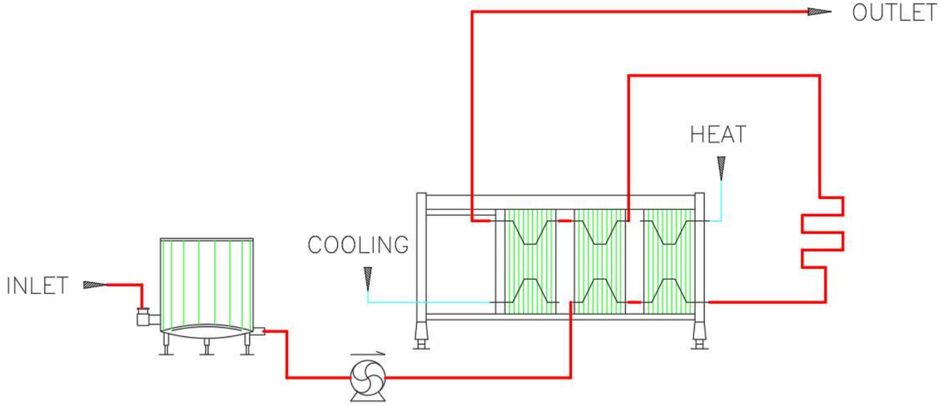
Carbon foot print in process room

What will limit running time?

Fouling

Bacteria count

Production schedule



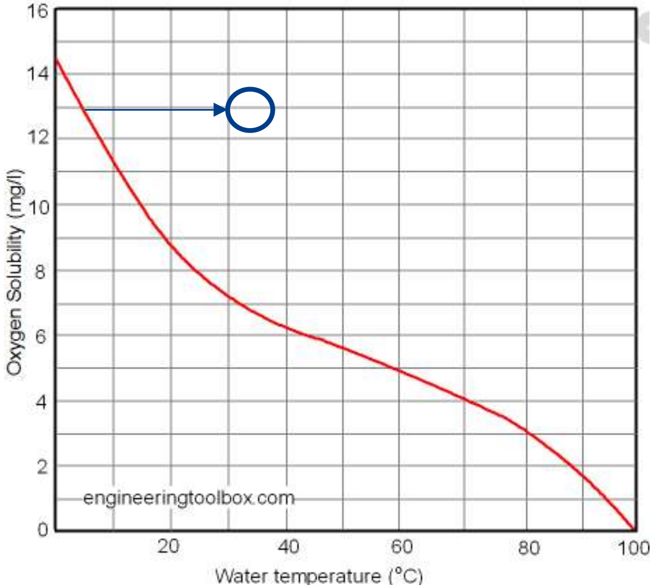
Fouling

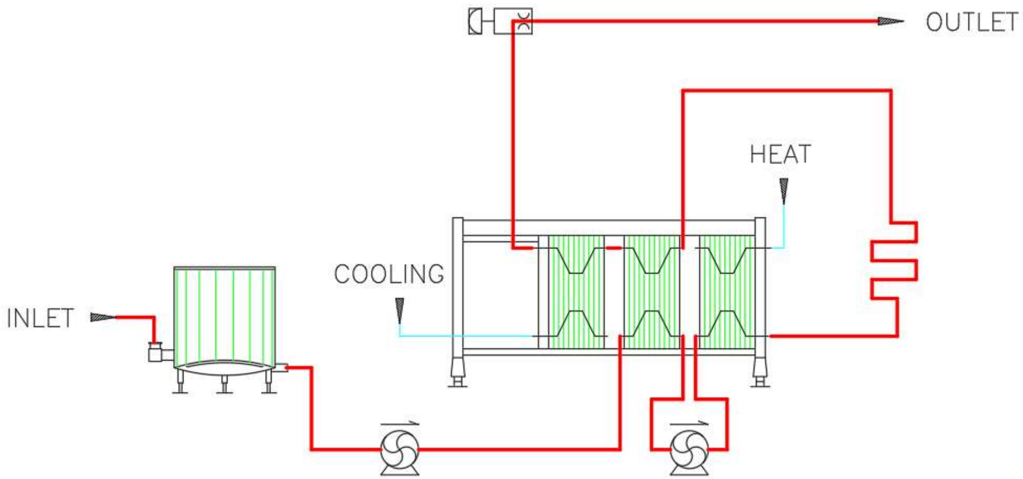
High surface temperature

Undissolved air (air bubbles)

”Disturbed” mineral balance

(Surface finish)



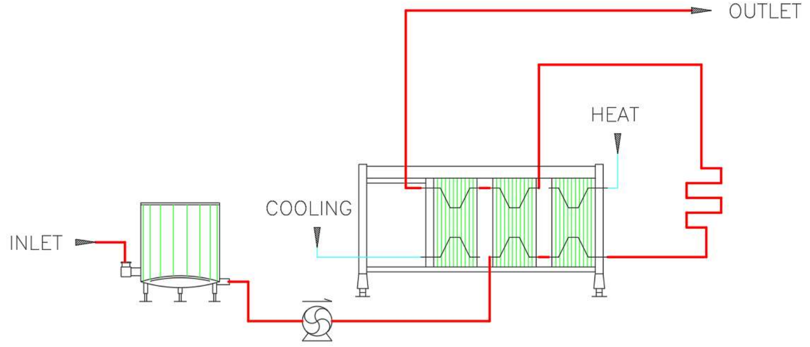


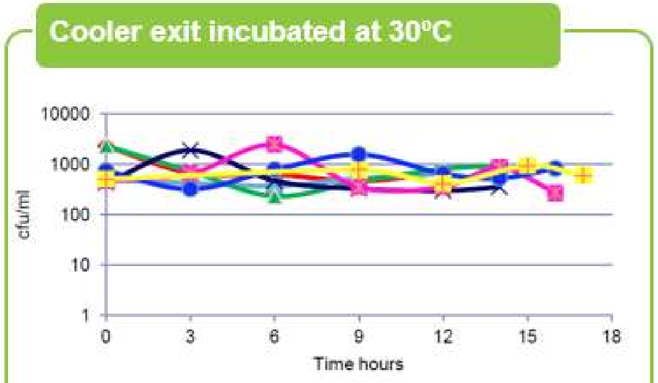
Pressure must be increased when heating the milk to avoid dissolved air

Thermoduric bacteria after pasteurisation

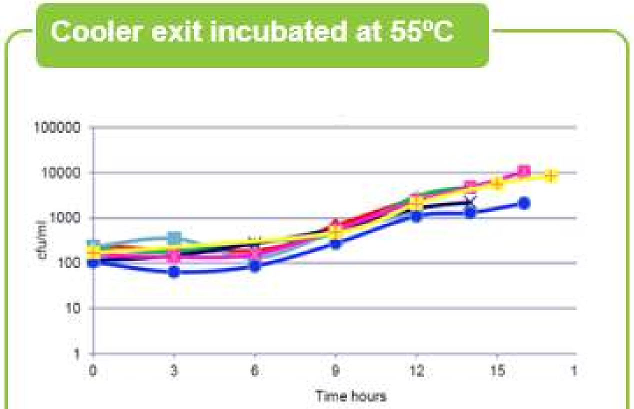
Bacterias and spores will be released from regen after some time

Will limit running time for some products, e.g. cheese, but not for chilled milk

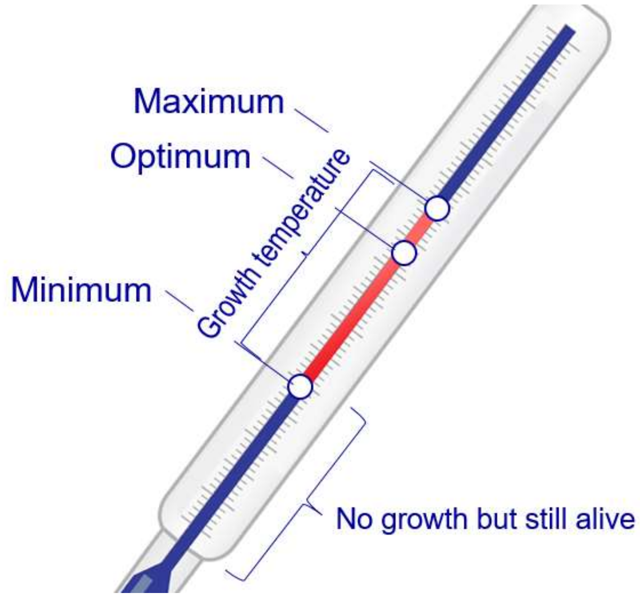




Bacteria count in pasteurized milk at the exit from the pasteurizer as measured by incubating at 30°C, seven different production runs.



Bacteria count in pasteurized milk at the exit from the pasteurizer as measured by incubating at 55°C, seven different production runs.



Product losses

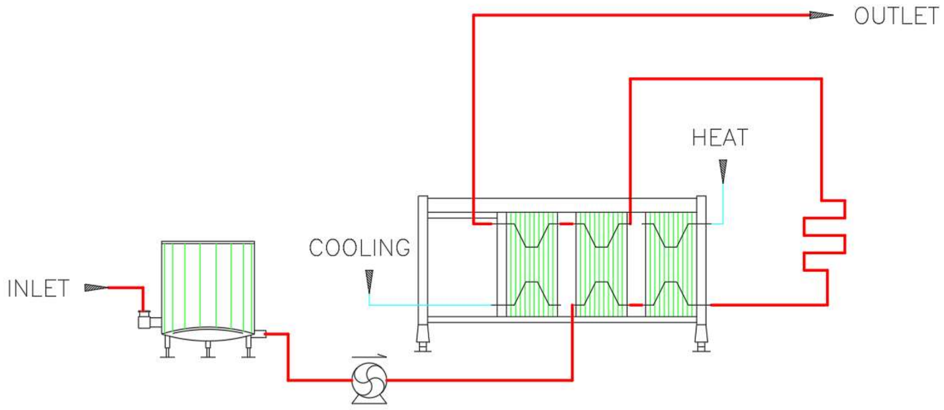
Carbon foot print in process room

Carbon footprint from product losses

Mix phases will occur at all fillings and emptyings

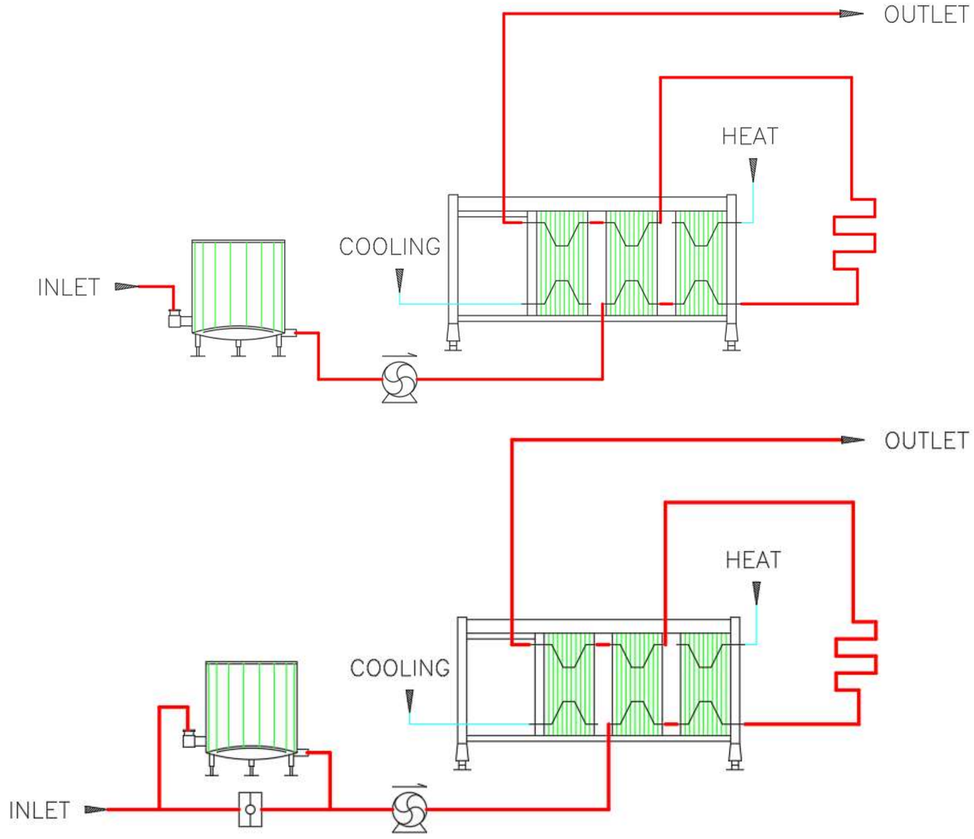
Reduce mix phases as much as possible

Recover mixphases



Low loss balance tank

Phase interface in pipe in stead of in balance tank



Cleaning

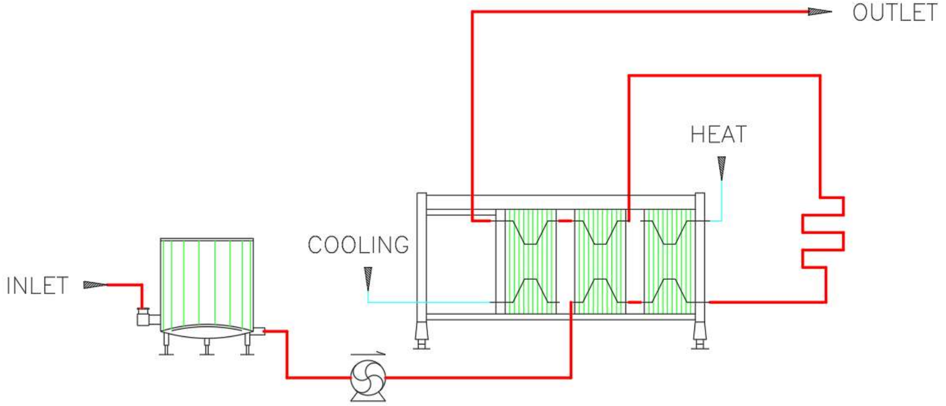
Carbon foot print in process room

Carbon footprint from cleaning

Heating of steel

Heating of liquids

Cooling to production temperature

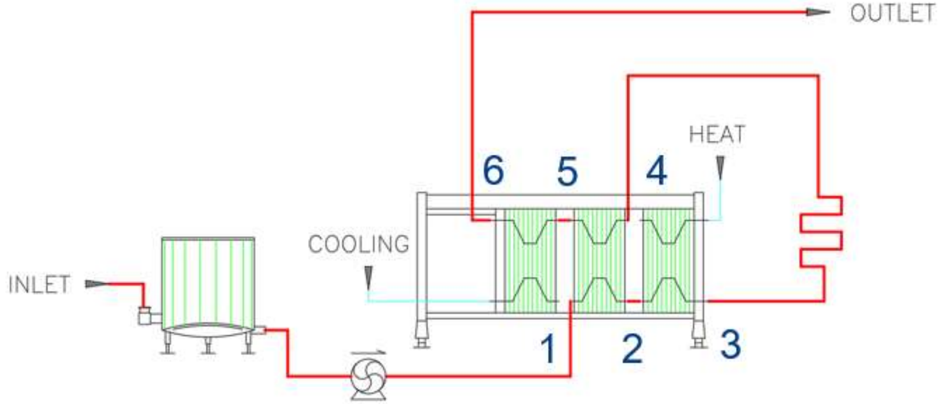


10.000 l/h pasteuriser – Around 200 kWh / 50 kg CO_2

Higher regen -> More steel and more liquid -> Higher carbon footprint

$$\text{Regeneration degree} = \frac{T2 - T1}{T3 - T1} = \frac{T4 - T5}{T4 - T6}$$

"Regen"

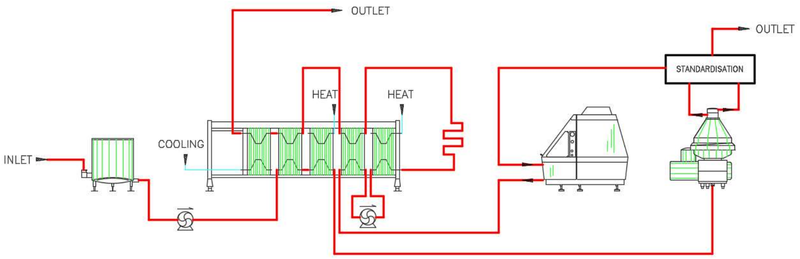


How does regen influence carbon footprint

Carbon footprint contributions

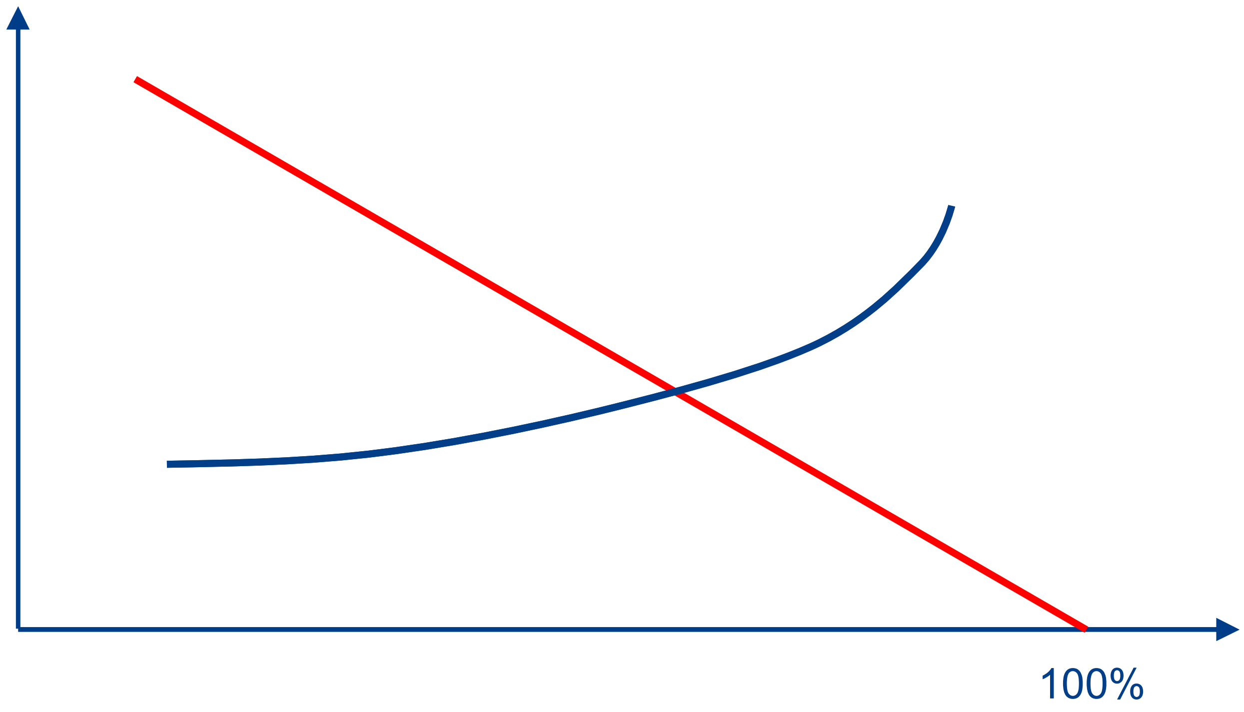
(10.000 l/h pasteuriser, 90% regen)

		CO_2 Kg/h	Note
Heating energy	80 kW	24	
Cooling energy	80 kW	16	
Pumps	5 kW	4	
Homogeniser	50 kW	35	Full stream
Separator	10 kW	7	
Product loss	40 kg/CIP	10	1 CIP / 8 h
CIP heating	200 kWh	7	1 CIP / 8 h
Steel		0	



Figures for guidance only

How regen and carbon footprint relates



So, what can we do?

Carbon foot print in process room

What actions can we do to reduce carbon footprint

Use energy sources with lower carbon footprint

- *”Green electricity”*
- *Heat recovery system with heat pump in stead of boiler*

Use efficient machines

- *Focus on design and operation of main machines (homogeniser & separator)*

What actions can we do to reduce carbon footprint

Longer running times

Will decrease the negative impact from product losses and cleaning energy when using high regen

- *Avoid fouling*
- *Know your bacterias and technology*
- *Tell market department to sell only one type of milk*

Reduce product losses

Will decrease the negative impact from product losses when using high regen

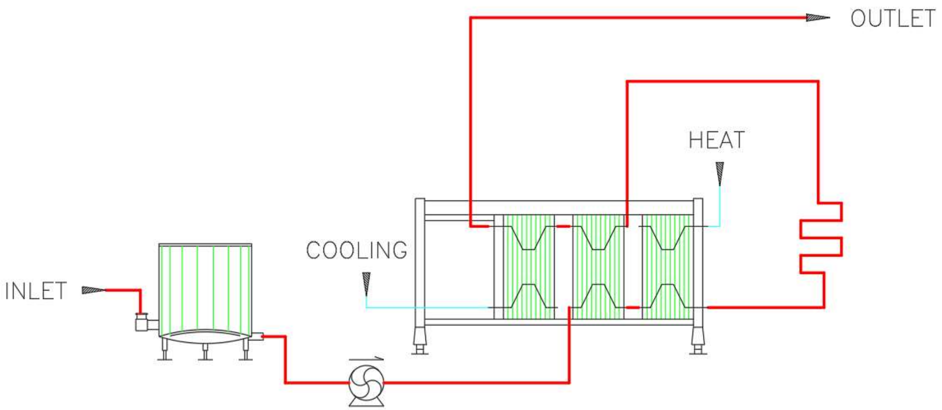
- *Create shorter mixphases*
- *Recover product*

What actions can we do to reduce carbon footprint

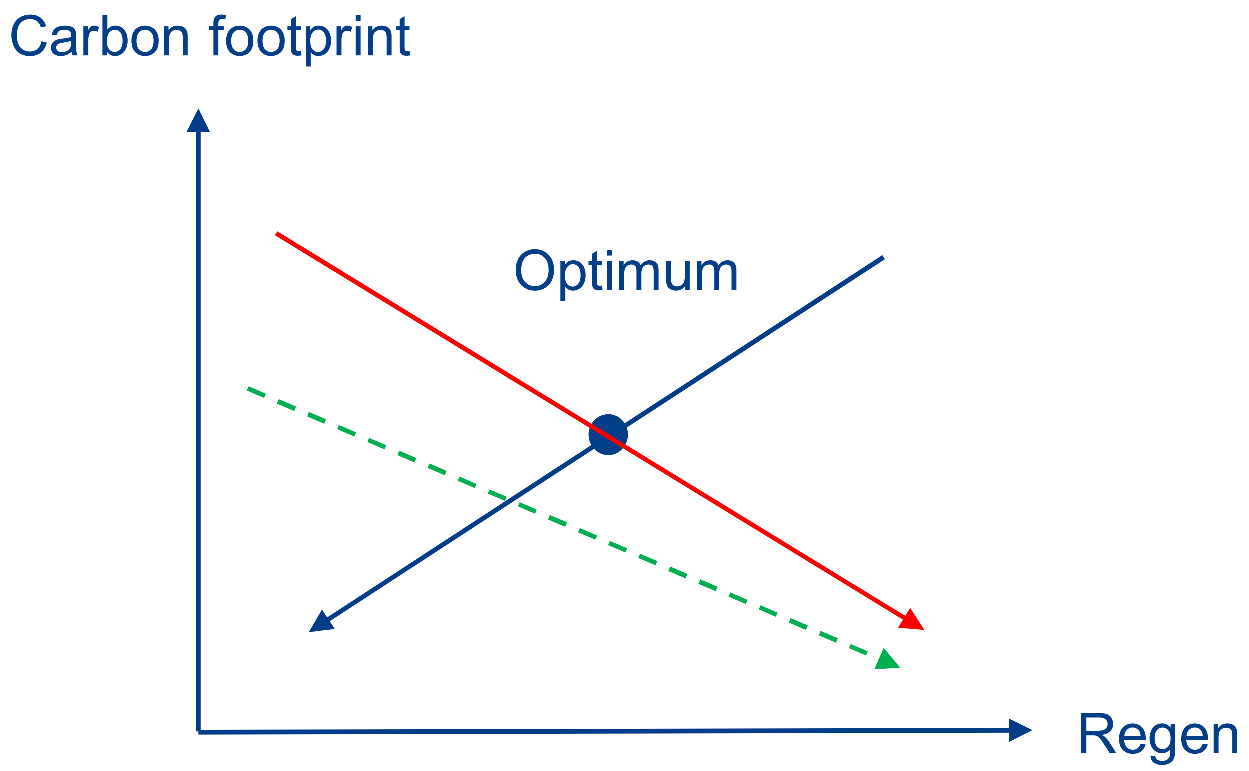
Higher regen

Must be balance against

- *Running times*
- *Product losses*
- *Energy sources for heating and cooling*



How regen and carbon footprint relates



Reduce heating energy

Reduce cooling energy

Longer running times

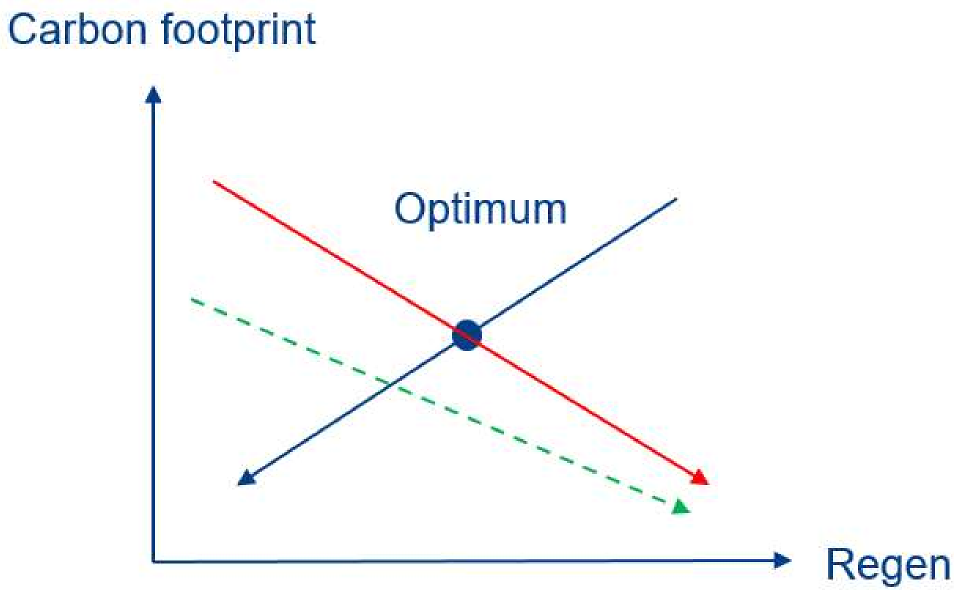
Reduce product losses

Reduce pressure drop

Reduce cleaning

Lower CO_2 heating media

Lower CO_2 cooling media



Reduce heating energy
Reduce cooling energy
Longer running times

Reduce product losses
Reduce pressure drop
Reduce cleaning

Lower CO_2 heating media
Lower CO_2 cooling media

End