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# Operations and various feeding systems, Economy of operation

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# Outline

- Introduction
- Different feed flow arrangements in Multiple effect evaporators
- Capacity of Multiple effect evaporators



## Introduction

The most commonly used evaporation plant in the dairy is falling film evaporating plant consists of the following components which are assembled together in the required manner.

- a) Heat transfer surface or calandria
- b) Liquid/vapour separation system
- c) Vapour removal system and vacuum control system
- d) Ancillary equipment such as pumps for extracting and conveying milk, cooling water pumps, valves, gauges, thermometers etc.



- a) Heat transfer surface
- b) Liquid/Vapor separation systems
- c) Vapor removal and vacuum control system
- d) Ancilliary equipment

## Different Feed flow arrangements in Multiple Effect evaporators

In a forward feed system, the flow of process fluids and of steam are parallel. Forward feed has the advantage that no pumps are needed to move the solution from effect to effect (not applicable to modern calandria type evaporator).

In a backward feed system, the feed flows counter to the steam flow. Pumps are required between the effects. The feed solution is heated as it enters each effect, which usually results in better economy than that obtained with forward feed.



## Capacity of Multiple effect evaporators

Although the use of the multiple-effect principle increases the steam economy, it must not be thought that there are no compensating disadvantages coordinate in importance with the economy of an evaporator system is the question of its capacity. By capacity is meant the total evaporation per hour obtained since latent heats are nearly constant over the ranges of pressure ordinarily involved, capacity is also measured by the total heat transferred in all effects. The heat transferred in these effects can be represented by the following equations

$$q = q_1 + q_2 + q_3 = U_1 A_1 \Delta t_1 + U_2 A_2 \Delta t_2 + U_3 A_3 \Delta t_3$$

$$q = U_{av} A (\Delta t_1 + \Delta t_2 + \Delta t_3)$$



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# Thank you