

The background of the slide is a tropical landscape. The top half shows a row of palm trees on a grassy bank overlooking a body of water. The bottom half shows a coastal town with many buildings and palm trees, situated on a peninsula or near a bay. The sky is blue with scattered white clouds. The slide is overlaid with large, semi-transparent geometric shapes in shades of orange and yellow.

Caustic Evaporation

Bertrams Chemical Plants Ltd

By Valérie Teil (CSO)

November 21st 2022



CloroSur
2022

COSTA DO SAUÍPE

Bertrams at a glance

- **History**

1894	Foundation of Bertrams Ltd. as a stove pipe manufacturer
BCPL	1999 M.B.O. (management-buyout), continuing the activities of Bertrams Ltd. in the field of chemical plants
BCN	2011 Opening of Beijing office
BCT	2016 Manufacturing site, Taicang
- **Asset**

Net Equity > CHF 11 Mio.
- **Annual business**

approx. CHF 50 Mio.
- **Head office**

Muttenz , Switzerland
- **Workforce**

approx. 100 employees
- **Certification**

ISO 9001 since 2001



Services and activities - Chlor/Alkali industry

- Feasibility study including lab test
- Basic engineering
- Detail engineering
- Plant construction
 - Engineering
 - Supply of key components
 - Turn-key installations or skid unit
- Field services (check of assembly, commissioning, start-up)
- Customer Service
 - Optimization of operation
 - Spare part business
 - Revamping



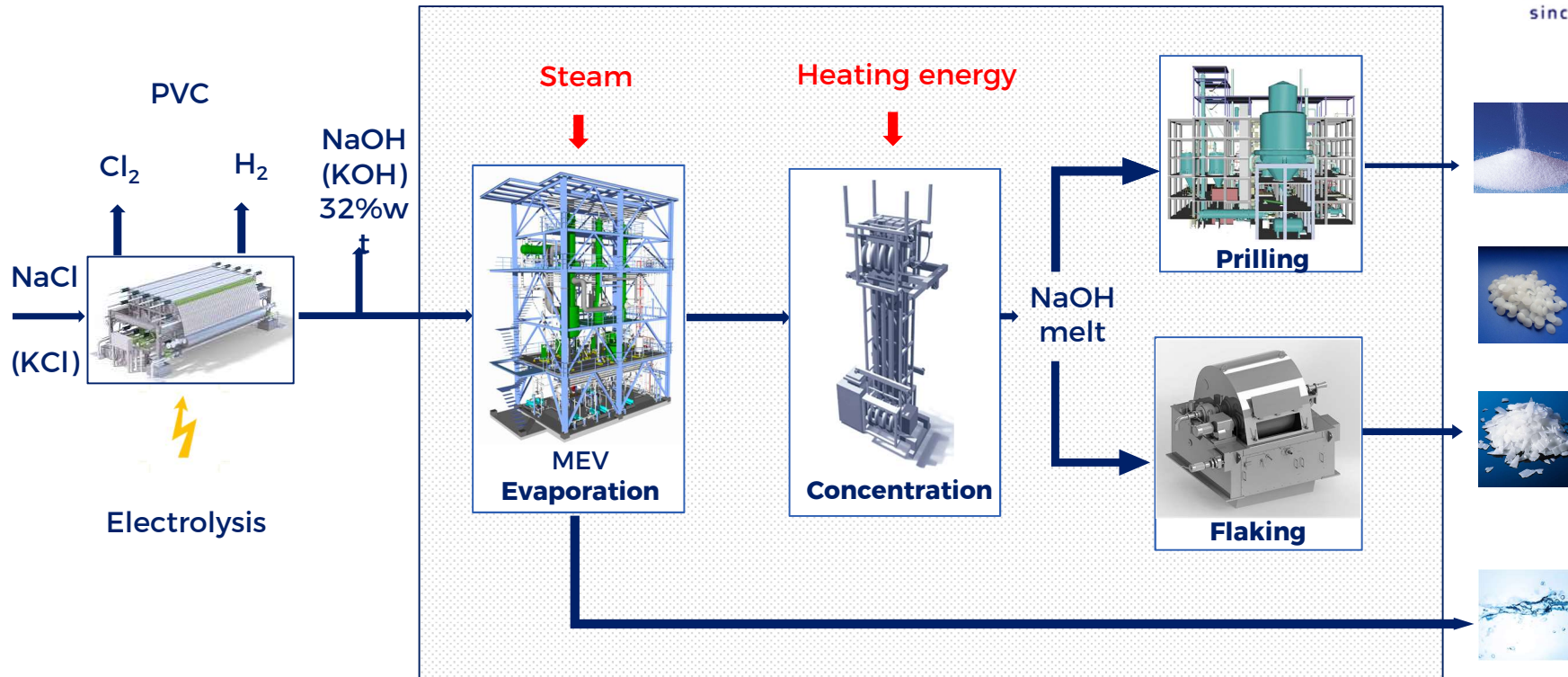
Scope of products - Chlor/Alkali industry



- Evaporation plants (MEV) 32 - 50% NaOH / KOH
- High concentration plants (50% to anhydrous)
- Flakers for production of caustic flakes
- Prilling plants
- Carbonation plants (K_2CO_3 / Na_2CO_3)
- Calcium chloride production plants ($CaCl_2$)
- Sulphuric acid concentration unit for chlorine drying application



BCPL 's Field of expertise - Chlor/Alkali industry



BERTRAMS Worldwide



More than

600 reference plants in 82 countries

- 290 evaporation plants (>10 above 1000 tpd)
- 317 concentration plants

Market Share

Approx. 70 % -
CEU

80 % -

CFU

**Over 27
million tonnes
installed capacities**

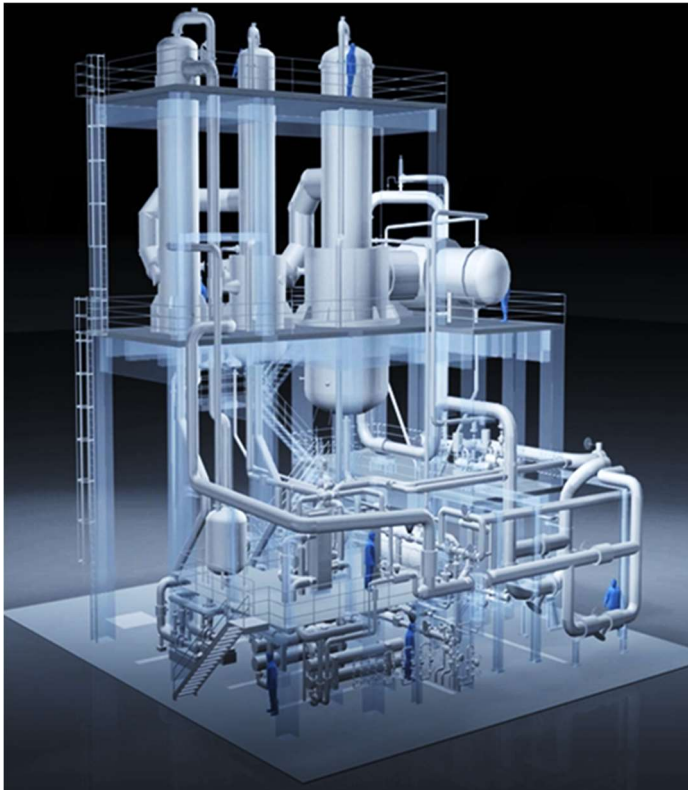




Caustic Evaporation Technology



Evaporation plants (MEV)



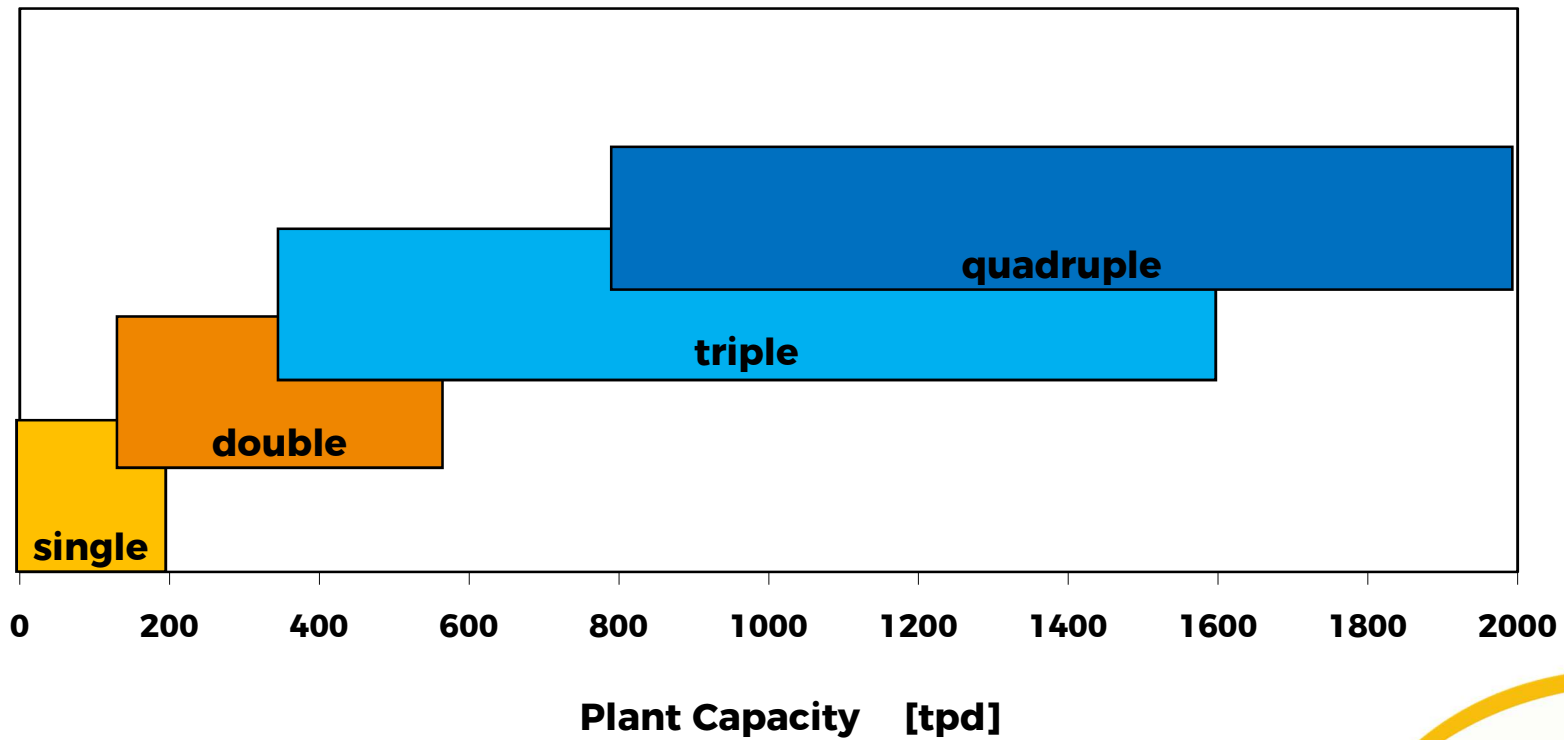
- Concentration of NaOH / KOH membrane solution from 32% wt. to 50% wt.
- Capacity from 15 to 2,500 tonnes per day as 100% NaOH
- Based on single or multiple effect falling-film technology
- Design with optimization of:
 - Investment
 - Energy consumption
- Recovery of condensate for further use in electrolysis plant



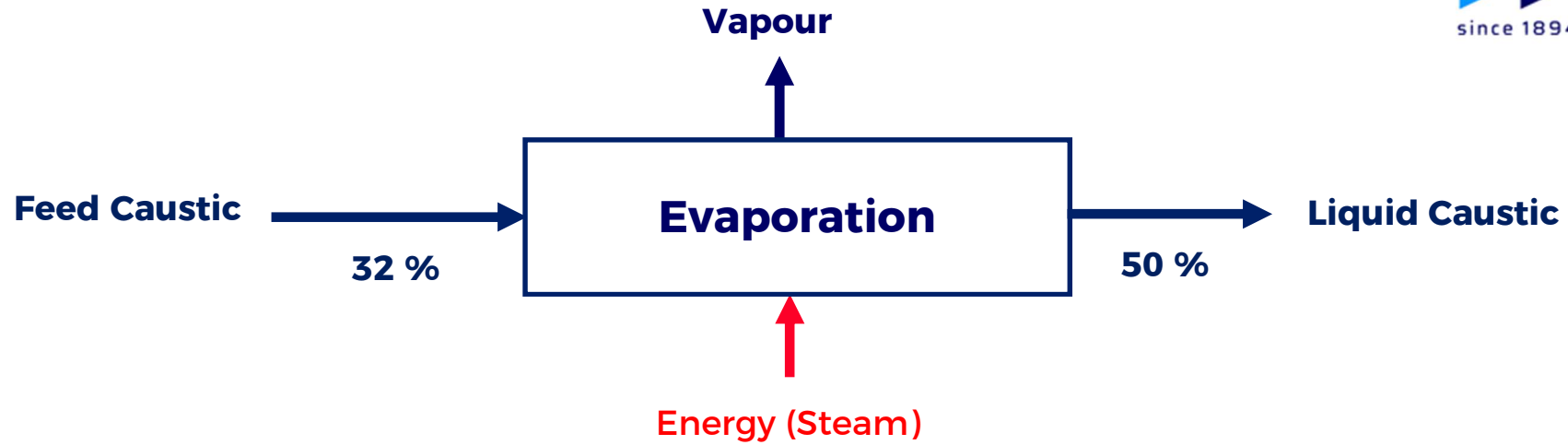
Evaporation plants (MEV)



Guideline for the selection of the type of evaporation unit



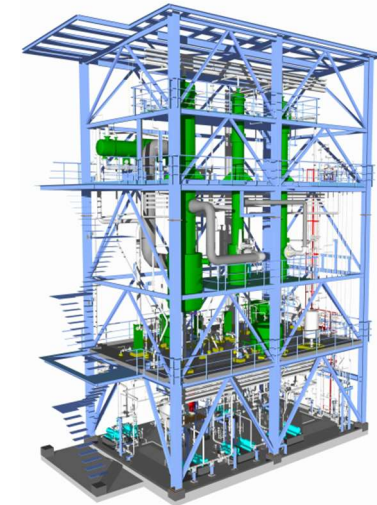
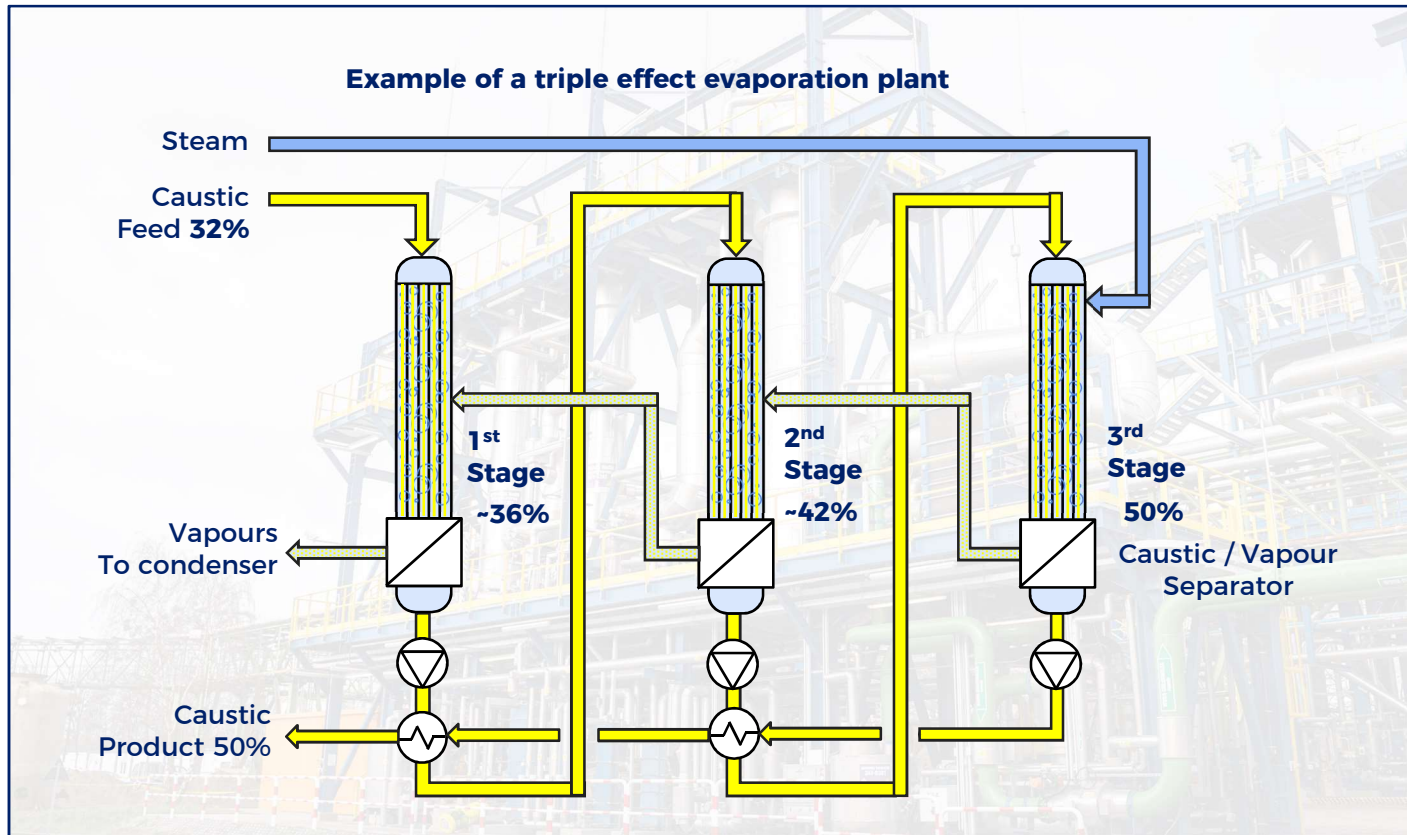
Evaporation plants (MEV)



	Steam consumption*	CO2 emission*
Single effect	1500	220
Double effect	750	120
Triple effect	500	80
Quadruple effect	390	65



Multiple effect caustic evaporation



Benefices of multiple effects: Case study



- NaOH evaporation plant (32% to 50%)
- Capacity : 300TPD as NaOH 100%
- Operating cost:
 - **2 stage plant** (750kg steam / ton NaOH 100%)
→ 0.75 t x 40\$* x 300t x 340days = 3.060.000\$ / year
 - **3 stage plant** (500kg steam / ton NaOH 100%)
→ 0.5 t x 40\$* x 300t x 340days = 2.040.000\$ / year
 - Saving in steam consumption = 1'020.000\$ / year**

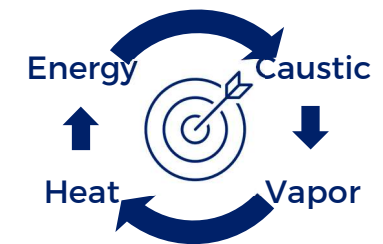
Higher CAPEX but **R.O.I. below 1 year**

* Basis : Steam price : 40\$ per ton

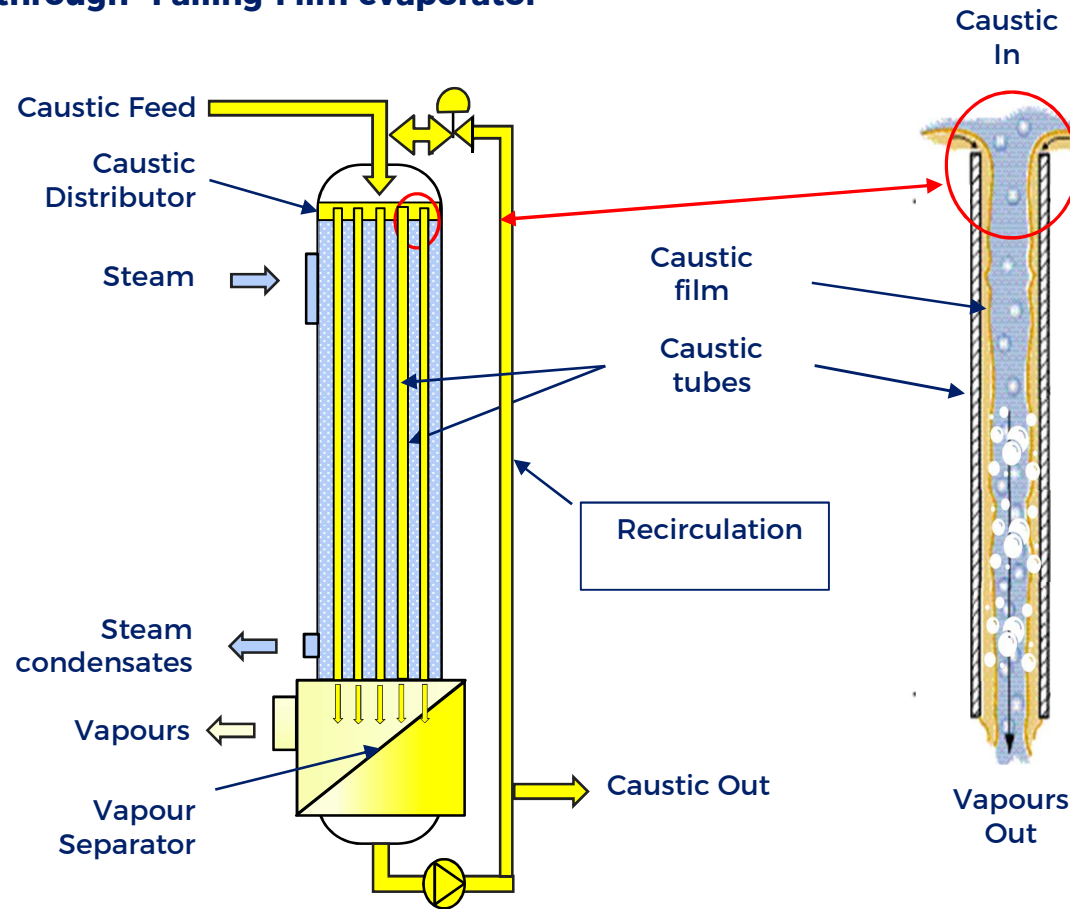
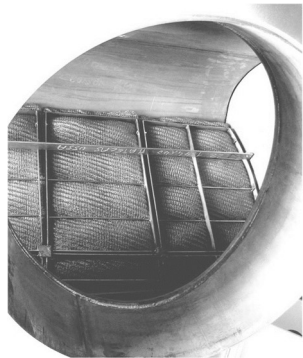
Bertrams Falling-film evaporator



- **One pass through mode** falling film evaporator
- **Own technology** developed and optimised by Bertrams
- Field proven, considered as **Best Available Technology (BAT)**
- Long life corrosion resistant materials (**SS, Ni**)
- Extremely high reliability → up to **8'400 hrs / year** uptime
- Design allowing minimum turndown ratio
- Multiple effects (up to 4-stage) to minimize energy consumption

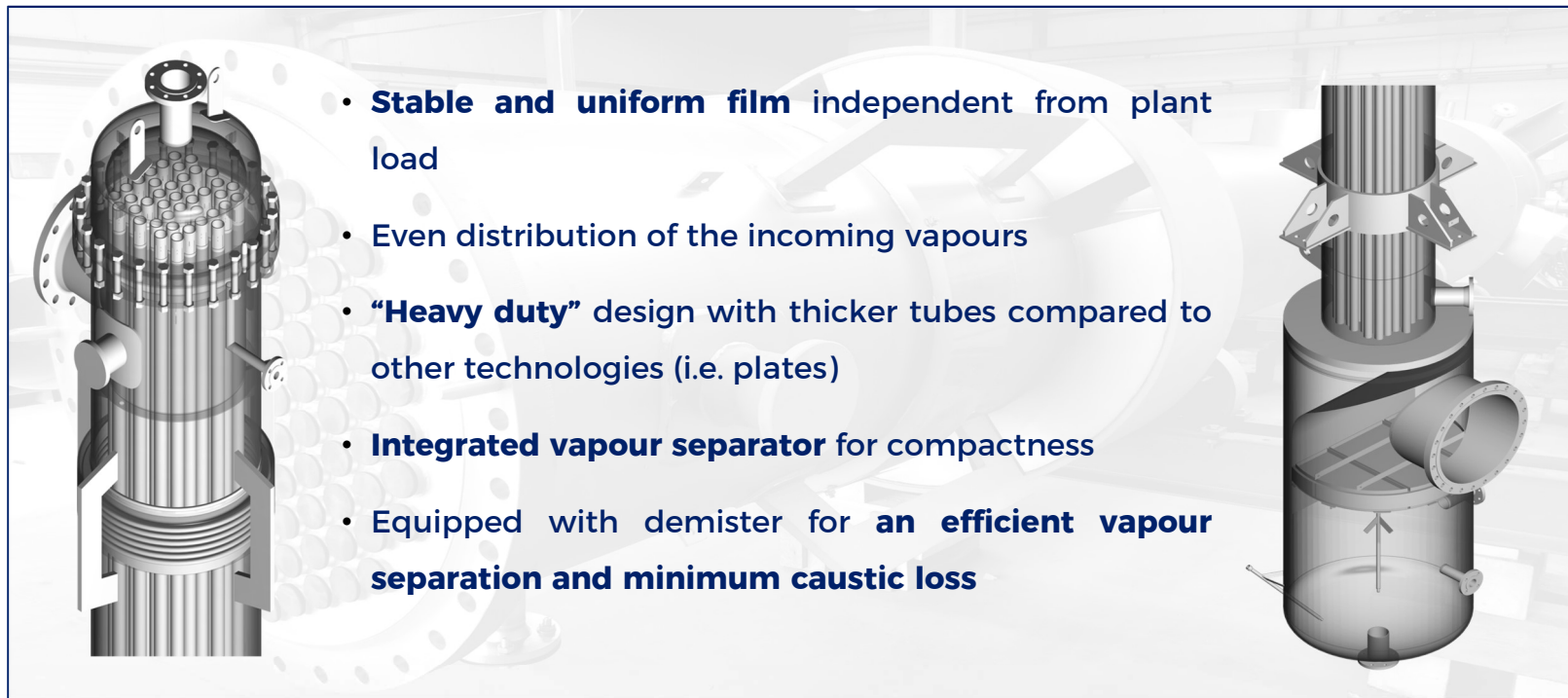


Bertrams "One pass through" Falling-Film evaporator

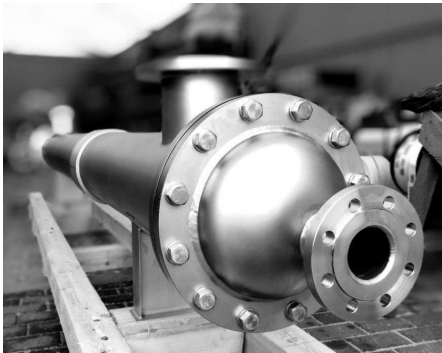


Bertrams
since 1894

Bertrams Falling-Film evaporator key specifications



Bertrams Heat Recovery



Shell & tube type caustic preheater



Becorex heat exchanger



Caustic Heat Exchangers

- Up to 150..155°C:
Plate type with gaskets
- Above 155°C:
Double Tube Type (Becorex)
Shell & Tube type



Safety & safeguards



Engineering phase

- HAZOP review
- Safety instruments (PSV)
- Interlock list

Plant

- Eyes and safety showers
- Protection housing for PHEs
- Splash guard protection on non insulated flanges

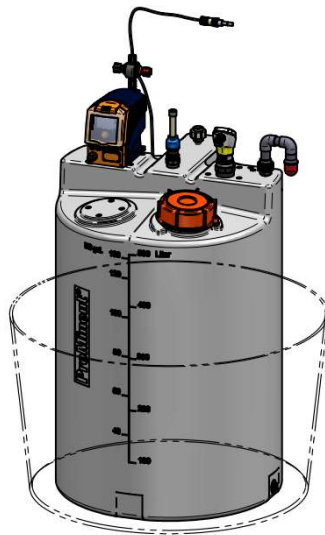


**Warning
Caustic**



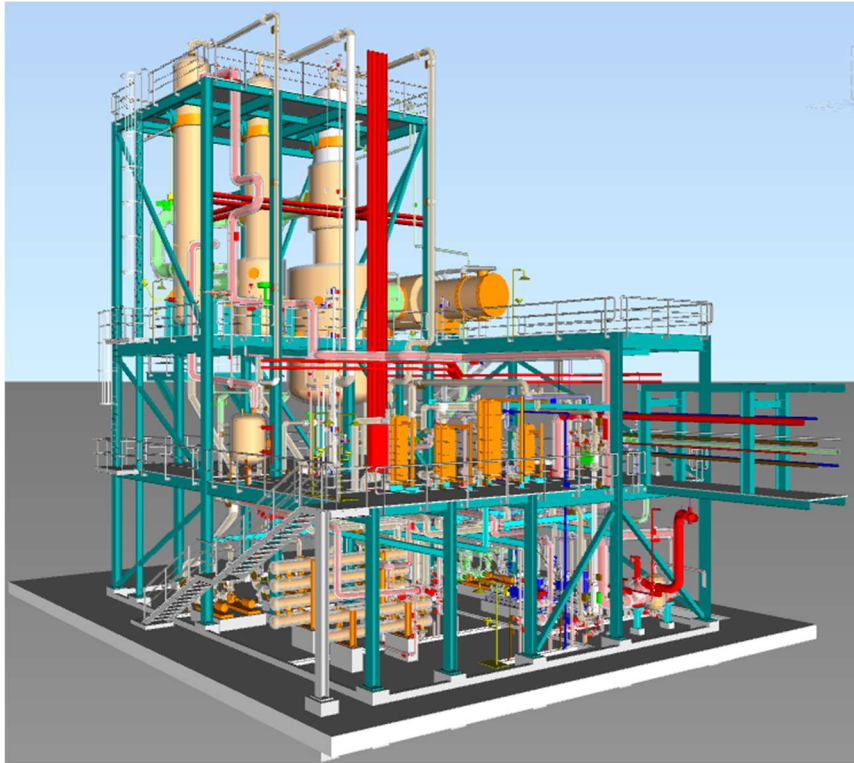
Safety & safeguards

Corrosion inhibitor dosing unit
to improve lifetime and product quality



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Examples of latest references

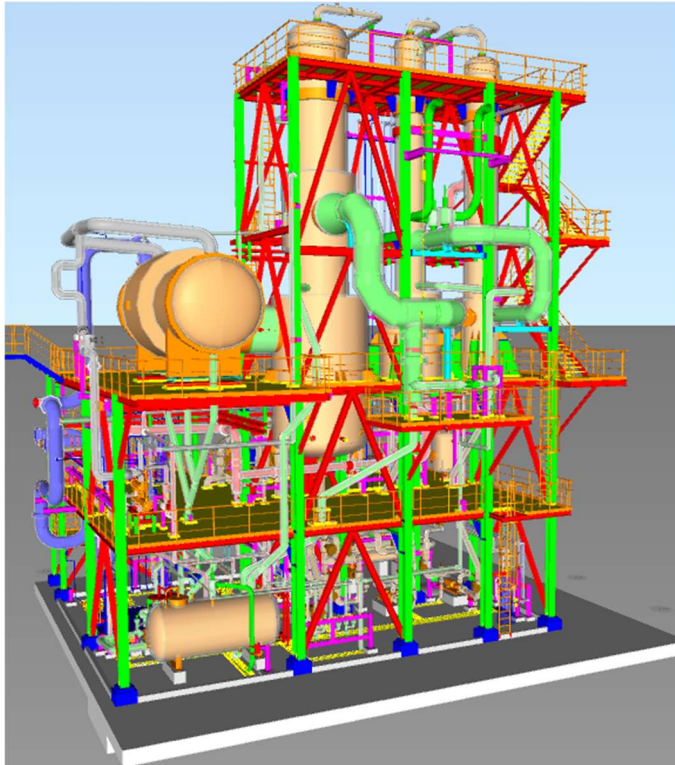


800 mtpd (as NaOH 100%) triple effect evaporation plant



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Examples of latest references



*1150 mtpd (as NaOH 100%) triple effect evaporation
plant*

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Examples of latest references



486 mtpd (as NaOH 100%) triple effect evaporation plant

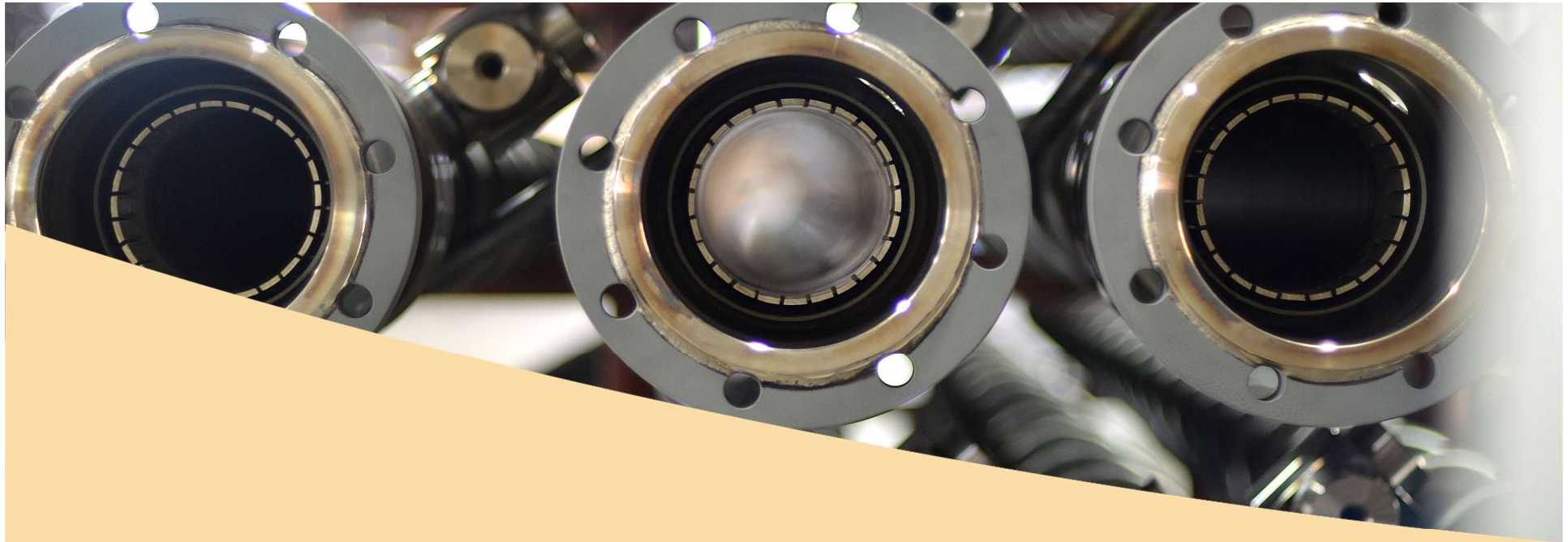


Examples of latest references



400 mtpd (as NaOH 100%) triple effect evaporation plant





Caustic Concentration and Flaking Technology

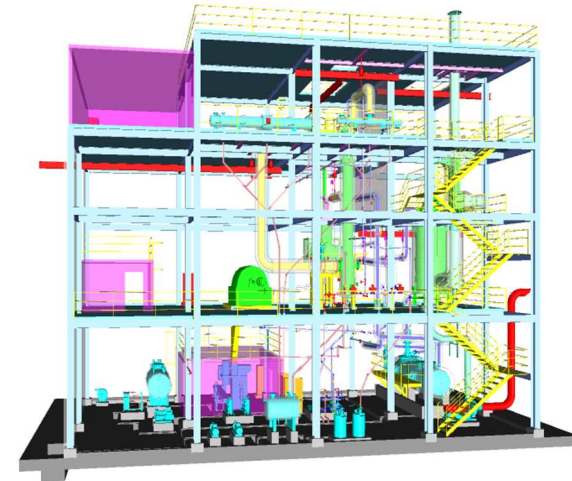


Concentration plant

- Concentration of NaOH up to **99% wt.** or KOH up to **90-95% wt.**
- Single or multiple stage design based on:
 - Targeted capacity
 - Energy cost
- Heat transfer medium required (molten salt or thermal fluids)
- Heating in operation can be done with fuel such as natural gas, fuel oil, diesel or hydrogen from the electrolyzer
- **Combined system with evaporation plant** for optimal energy recovery (feed 32% NaOH)

More than 315 concentration plants supplied worldwide

Bertrams
since 1894



 **CloroSur**

Final Falling Film Concentrator

- **Modular design**
- Standard concentrator elements made of **pure nickel**
- Heated by thermal fluid (molten salt)
- Individual heating jacket expandable in all directions
 - ➔ no thermal stress
- Easy maintenance
- No pumping system to flaker (gravity flow)
- Operation under atmospheric pressure
 - Easy operation, reduced spillage
 - No air entering or leaking
- Special distribution system



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since 1894

Flaking Unit

Result of years of research and development gained in the manufacture of more than 350 flakers

- Production of flakes at 55-60°C from melts (NaOH, KOH, Na₂S and CaCl₂)
- Special rotating cooling drum, cooled by cooling water in completely sealed system
- Rotation speed controlled by variable speed drive
- Dipping vat tiltable for full draining and easy maintenance
- Reliable design of the scraping device
- Standardized machine

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BERTRAMS : Your partner in caustic concentration



- Proven and reliable technology
- 75 years of track record
- More than 300 reference plants worldwide
- **Market leader and benchmark** in the caustic technology

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BERTRAMS - selected references



QUIMPAC S.A.



Formosa Plastics®



Thank you .

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