WILK-GRAPHITE
EQUIPMENT FOR THE CPI

Energy and CO2 saving with corrosionless silicone carbide equipment and system

A revolution for the chlor-alkali industry

Cefic sector group

euro chlor 17.

12th International Chlor-Alkali Technology Conference & Exhibition

13-15 May 2025
Barcelona - Spain

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AGENDA

- Wilk-Graphite presentation
- Sintered silicon carbide introduction
- SSIC block heat exchanger
- Our different technologies suitable for the chlor-alkali industry
- Pilot plant
- Conclusion

Cefic sector group

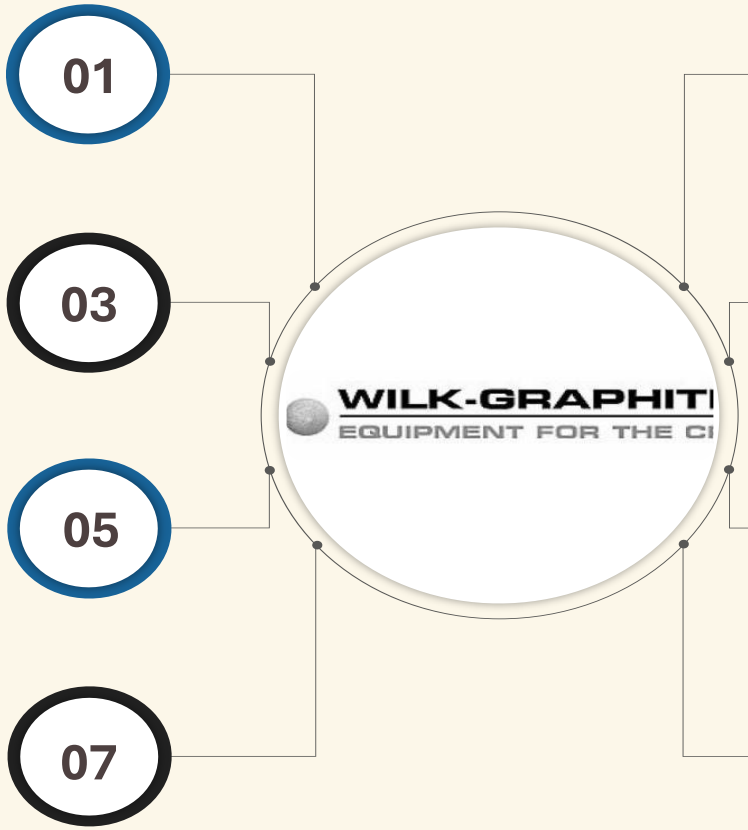
Wilk Graphite Presentation

World leading company for NoMoCorr SIC block heat exchanger

Active since 2005 in Graphite equipment, SIC and PTFE

German / French based, engineering, production and sales

Internationally recognized solutions provider



Developed the ExtrAcid system

More than 2´000 equipment / plants sold last 15 years

Multiple patent holder

Achema Award Winner 2018

NoMoCorr® Sintered Silicon Carbide

No

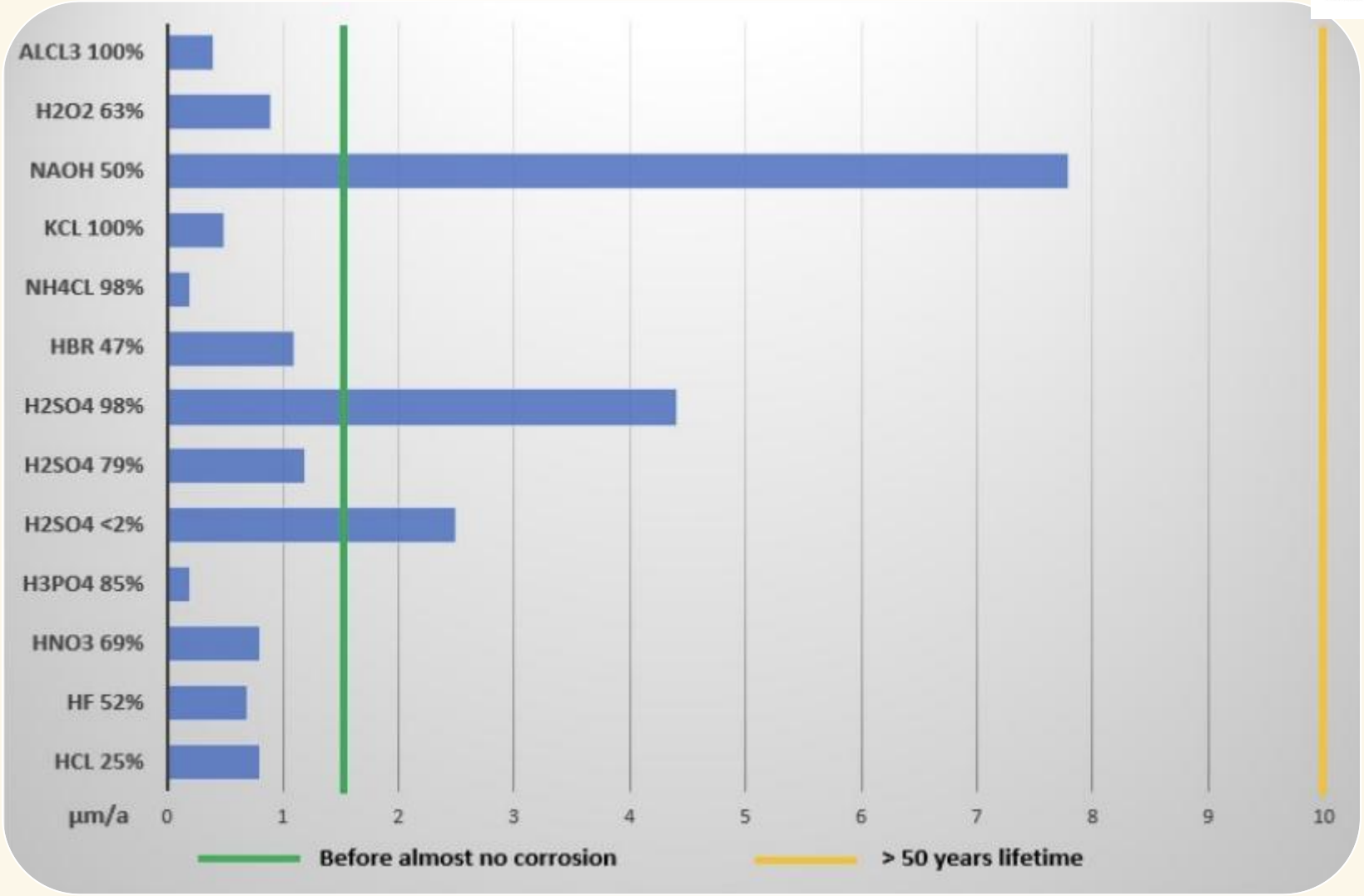
More

Corrosion

Bye bye corrosion !

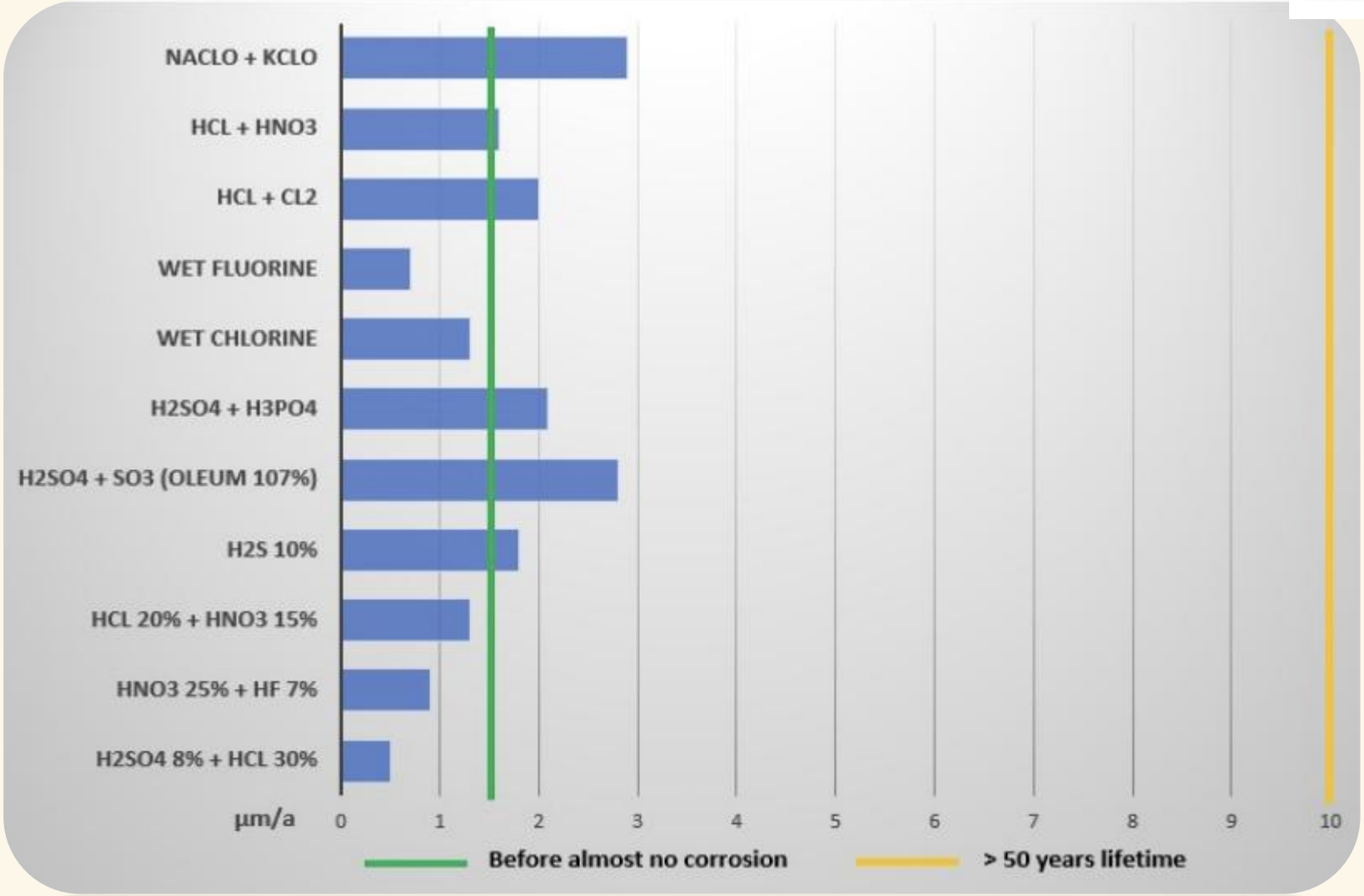
NoMoCorr® Sintered Silicon Carbide

Typical corrosion rate



NoMoCorr® Sintered Silicon Carbide corrosion table

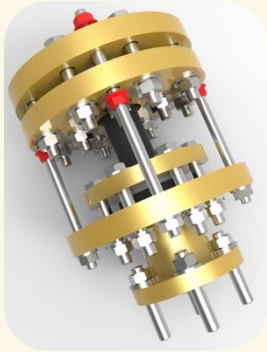
Typical corrosion rate

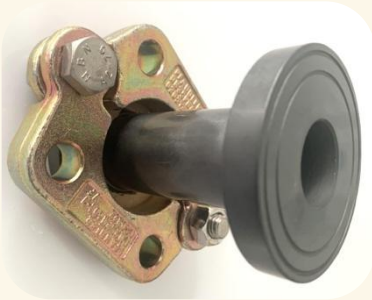


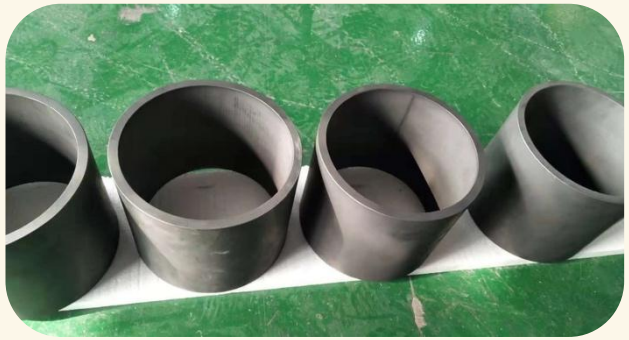
NoMoCorr® Sintered Silicon Carbide

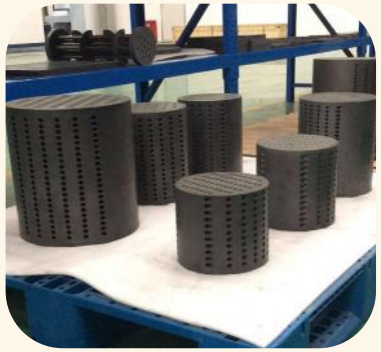
Our solutions based on SIC Technology

- Heat exchangers / Evaporator
- Concentration systems
  - NaOH / KOH up to 99%
  - H2SO4 up to 98%
  - HCl up to 20%
  - CaCl2 up to 72%
  - HF up to 40%
- Production plants
  - HCl synthesis unit gas or liquid
  - DCP / phosphoric acid using HCl route









NoMoCorr SIC

NoMoCorr® SSIC block heat exchanger

- Up to 50 barg and 450 °C
- Thermal shock resistant (25 °C / min)
- Low cost and easy maintenance
- High thermal coefficient
- Fouling proof and self cleaning
- Compact
- None ageing
- High resistance to abrasion and thermal shock
- Over 200 units in operation worldwide

ExtrAlkali® - Concentration Plant

NaOH / KOH systems

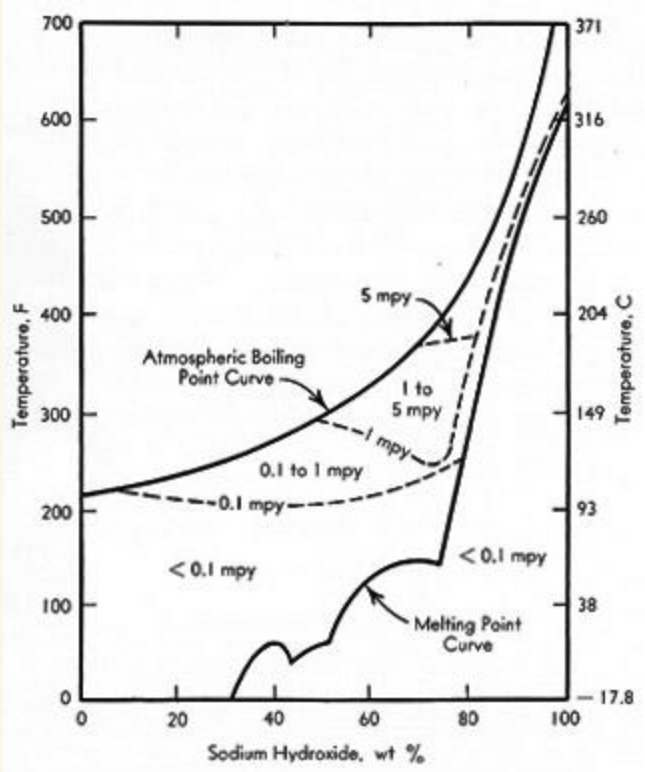
- Typical consumptions (32% wt NaOH IN / 50% wt NaOH OUT)

	Themal oil consumption per ton of NaOH 100 % (kg) (kW)	Steam consumption per ton of NaOH 100 % (kg) (ton)	CO2 emmissions per ton of NaOH 100 % (kg)
1 effect	1020	1500	220
2 effect	510	750	110
3 effect	340	500	73
4 effect	255	375	55
5 effect	204	300	44
6 effect	170	250	37
7 effect	146	214	31
8 effect	128	188	28

ExtrAlkali® - Concentration Plant

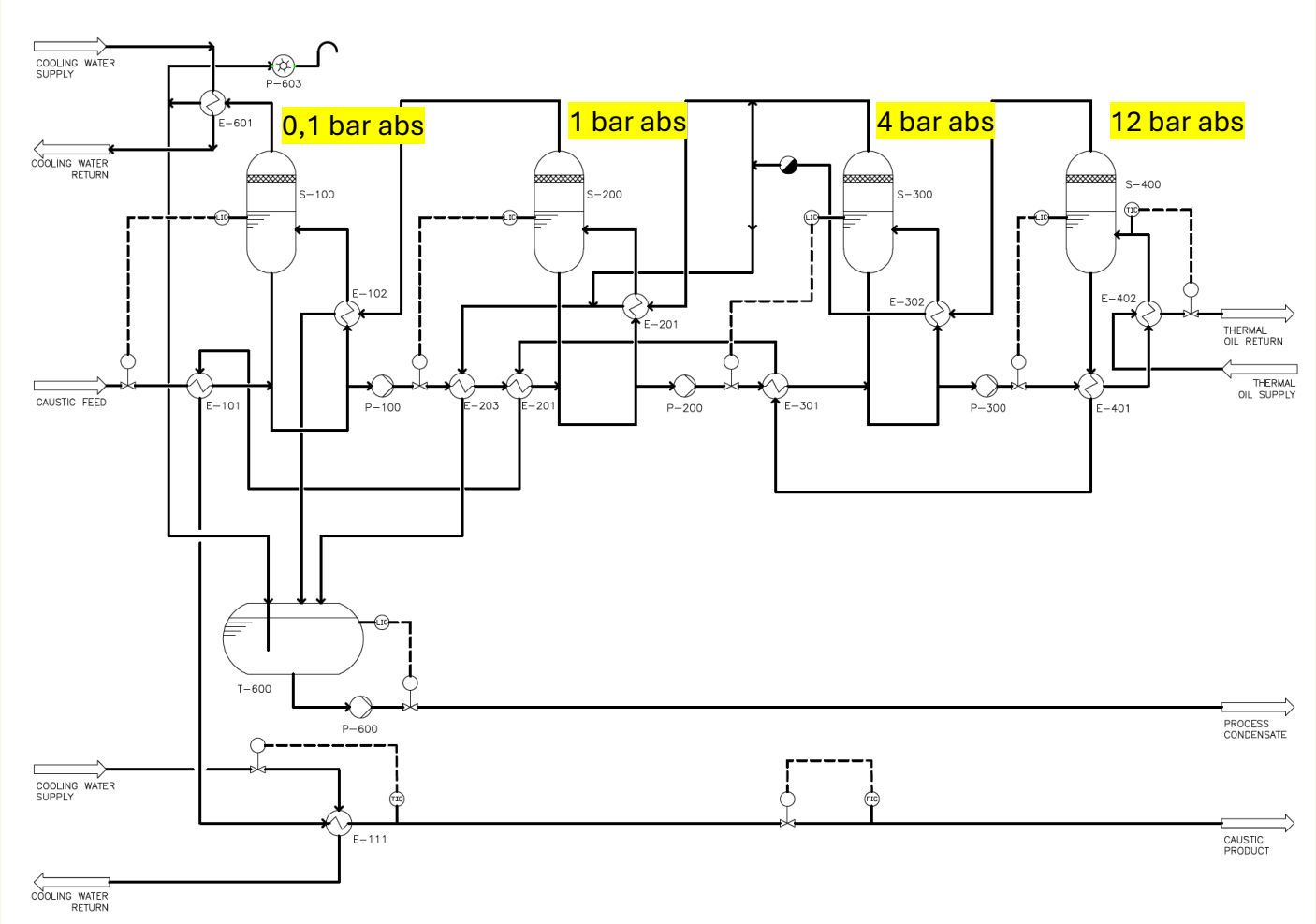
NaOH / KOH systems up to 50% wt NaOH

- First company worldwide offering systems up to 6 effects
  - Technology based on a process working by high temperature (up to 300 deg and 25 bar abs)
- No corrosion with SIC in comparison with pure Nickel at elevated temperature (180…300 °C)
- Excellent CAPEX
  - Small equipment thanks to large temperature profile (LMTD)
  - Overall small plant footprint



ExtrAlkali® - Concentration Plant

NaOH / KOH systems up to 50% wt NaOH – 4 effects

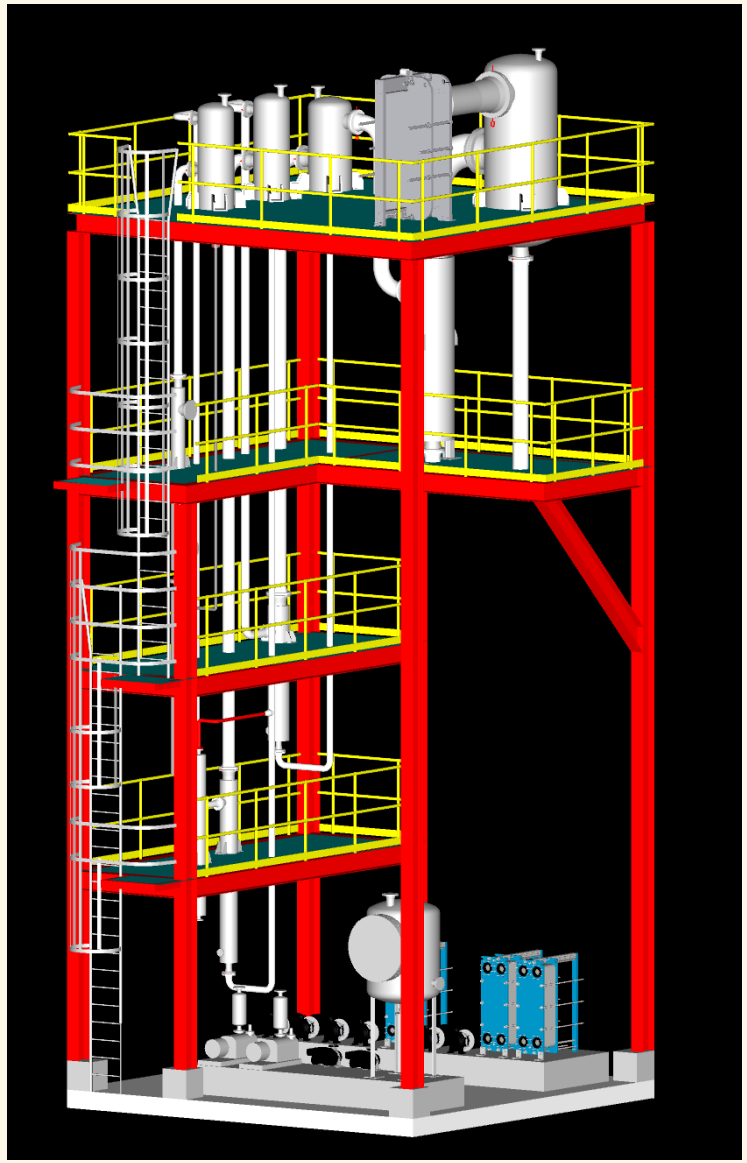


Thermal oil at 360 deg C

ExtrAlkali® - Concentration Plant

NaOH / KOH systems up to 50% wt NaOH

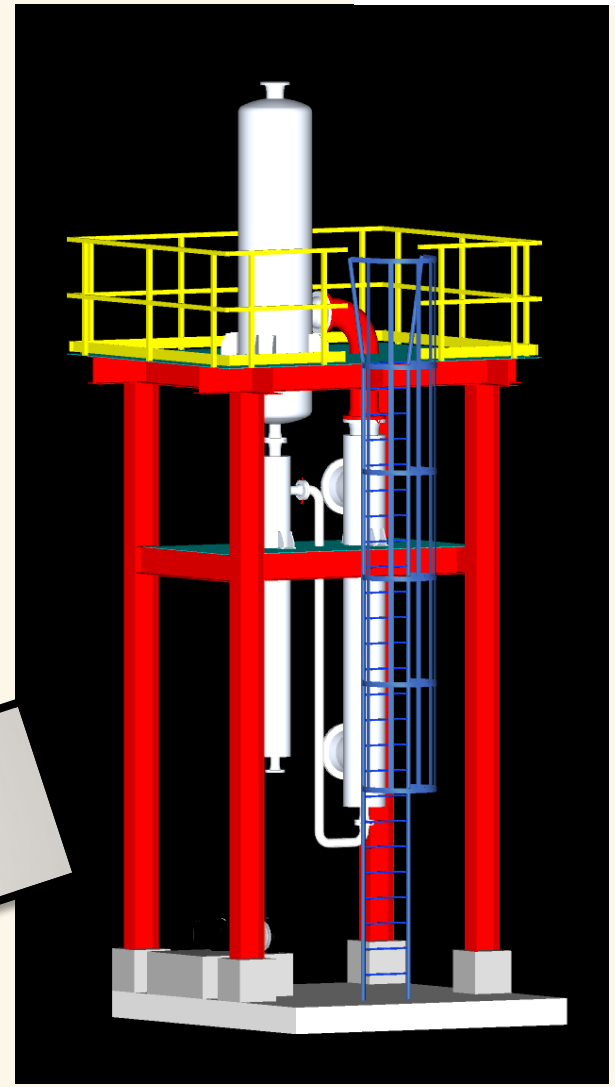
- Very compact layout for a 200 TPD plant (less than 6 x 6m footprint)
- Good access to all evaporators / heat exchangers
- Light steel structure
- For low capacities possibility to supply the unit as SKID mounted



ExtrAlkali® - Concentration Plant

Revamping of NaOH / KOH systems up to 50% wt NaOH

- We saw in slide 11 that the first effect produce steam at 10..15 barg in the first effect
- New module for revamping
  - One effect in SIC
  - Small footprint (4 x 4 m)
  - Possible to deliver the module SKID mounted
- Generated steam at 8..12 barg will be sent to an existing concentration system (double or triple effect)
- Existing system needs no modification
- Saving in energy 22 up to 50 %



ExtrAlkali® - Concentration Plant

Cutting-Edge Technology – Heat pump

- Reduce further by two the overall energy consumption by integrating in our plant concept with Special Heat Pump
- Specific consumption of a triple effect become specific consumption of a sextuple effect
- Specific consumption of a quadruple effect become specific consumption of an octuple effect
- Proven technology many time installed for large industrial applications (more than 15 MW)
- ROI, approx. 2 to 3 years

ExtrAlkali® - Concentration Plant

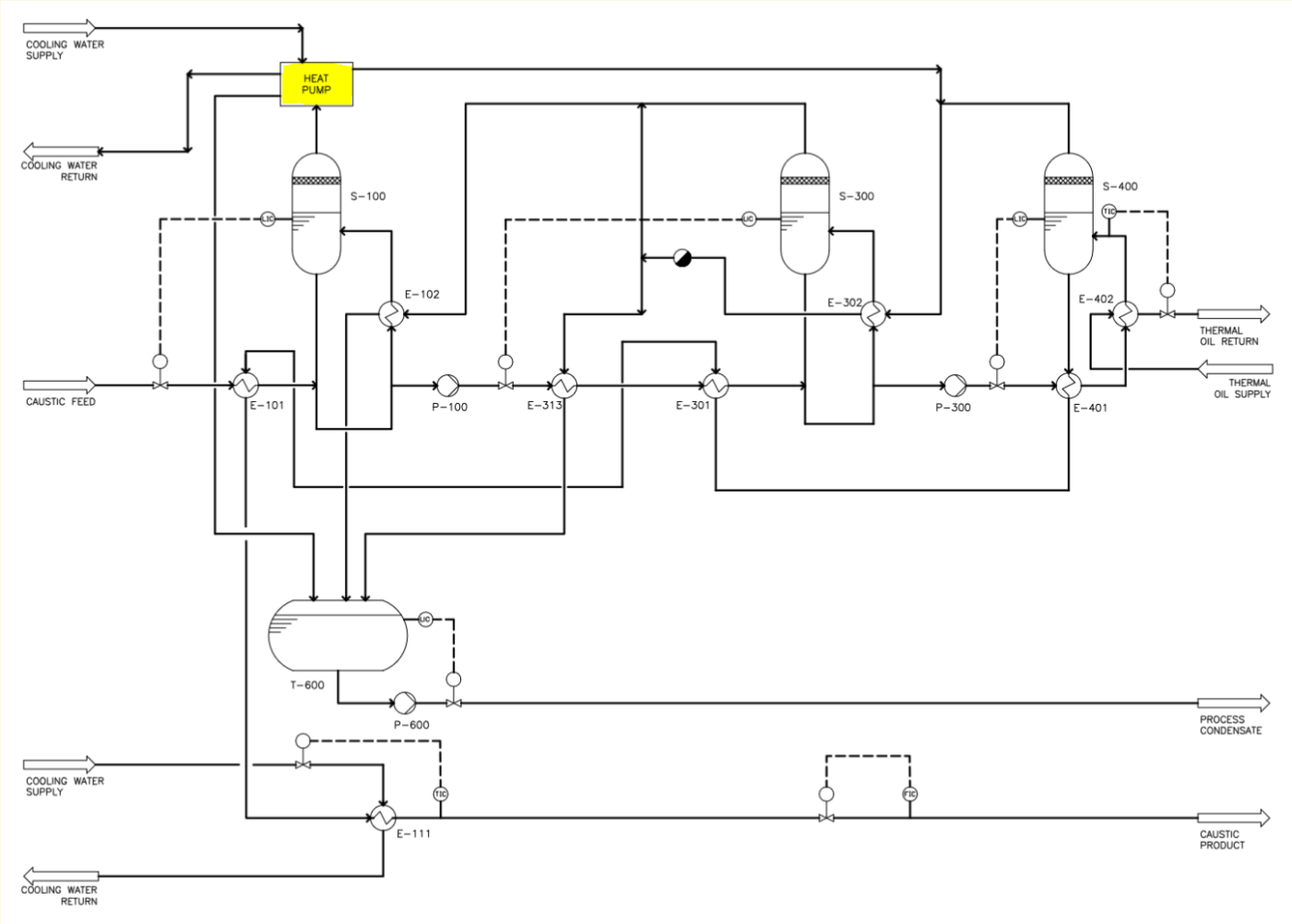
Cutting-Edge Technology – Heat pump

	Themal oil consumption per ton of NaOH 100 % (kg) (kW)	Steam consumption per ton of NaOH 100 % (kg) (ton)	CO2 emmissions per ton of NaOH 100 % (kg)
1 effect	1020	1500	220
2 effect	510	750	110
3 effect	340	500	73
4 effect	255	375	55
5 effect	204	300	44
3 effect with heat pump	170	250	37
7 effect	146	214	31
4 effect with heat pump	128	188	28

ExtrAlkali® - Concentration Plant

NaOH / KOH systems up to 50% wt NaOH

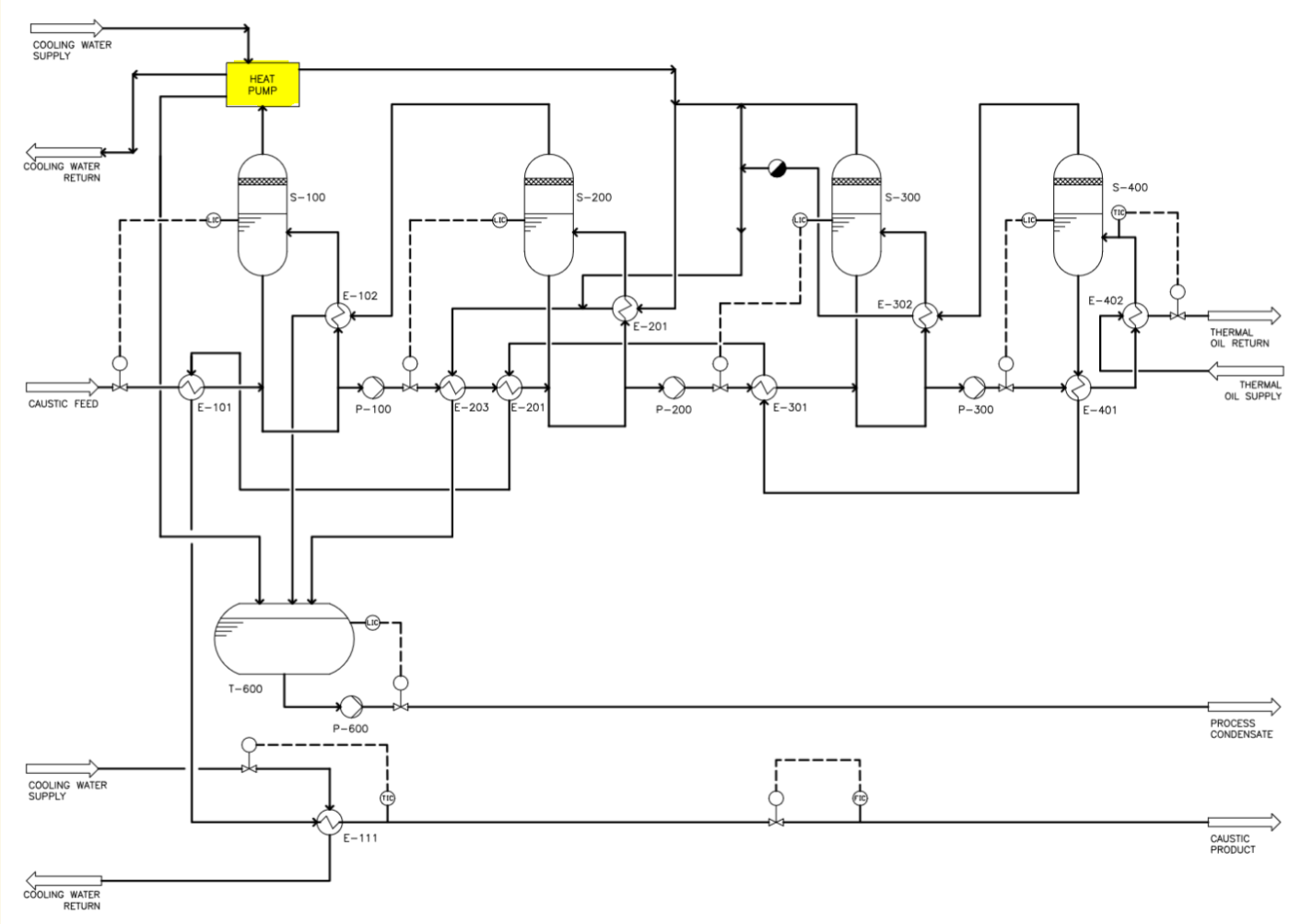
3 effect with heat pump



ExtrAlkali® - Concentration Plant

NaOH / KOH systems up to 50% wt NaOH

4 effect with heat pump



ExtrAlkali® - High concentration Plant

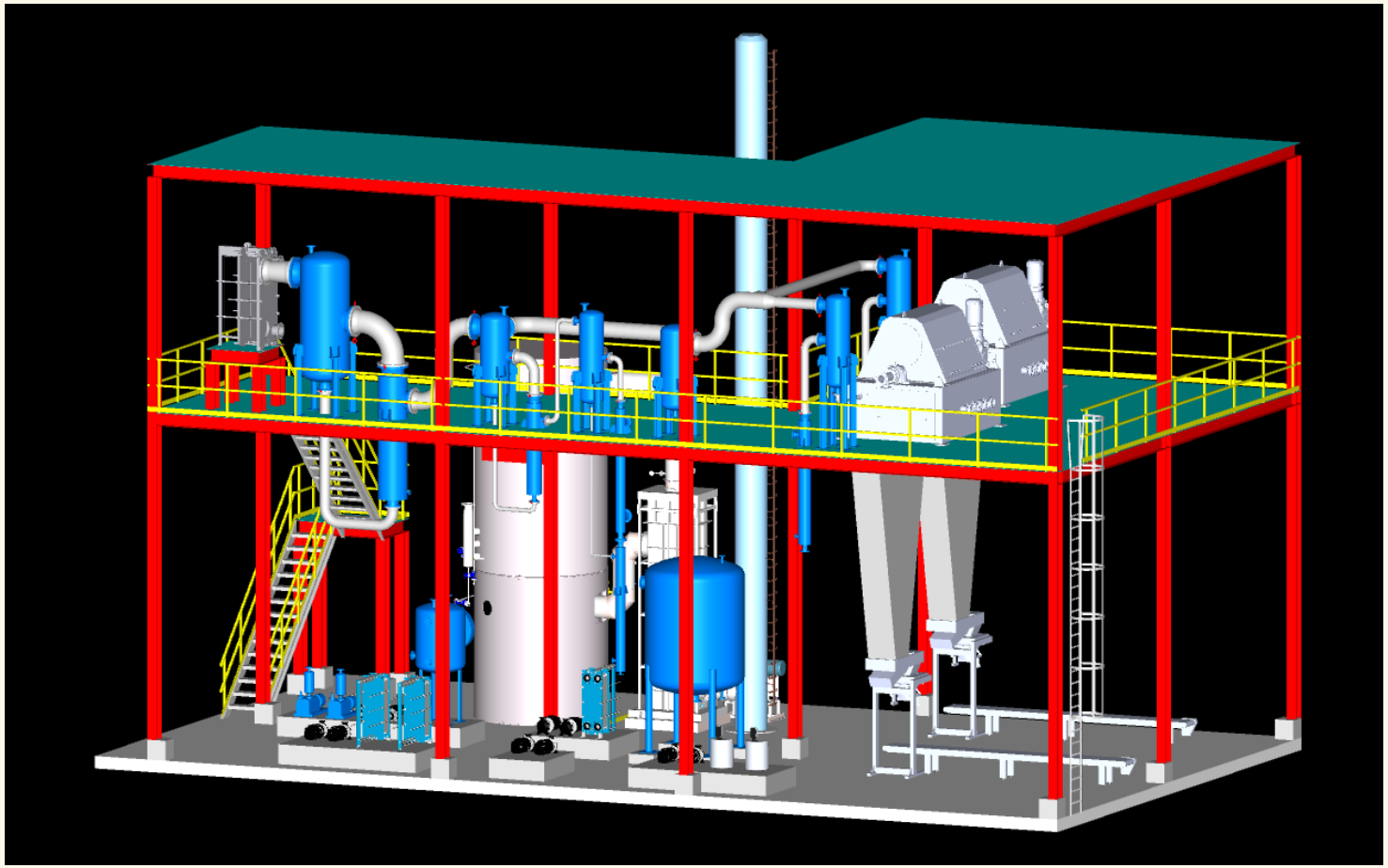
Concentration above 50% wt NaOH / KOH

- Core competence concentration up to 99% to solid
  - Using thermal oil or electrical heating especially for our finisher (up to 99,5% tot solid)
- Partners for processing into a solid form such as flaking machine
- Single point solution including partner scope

ExtrAlkali® - High concentration Plant

Flaking plant

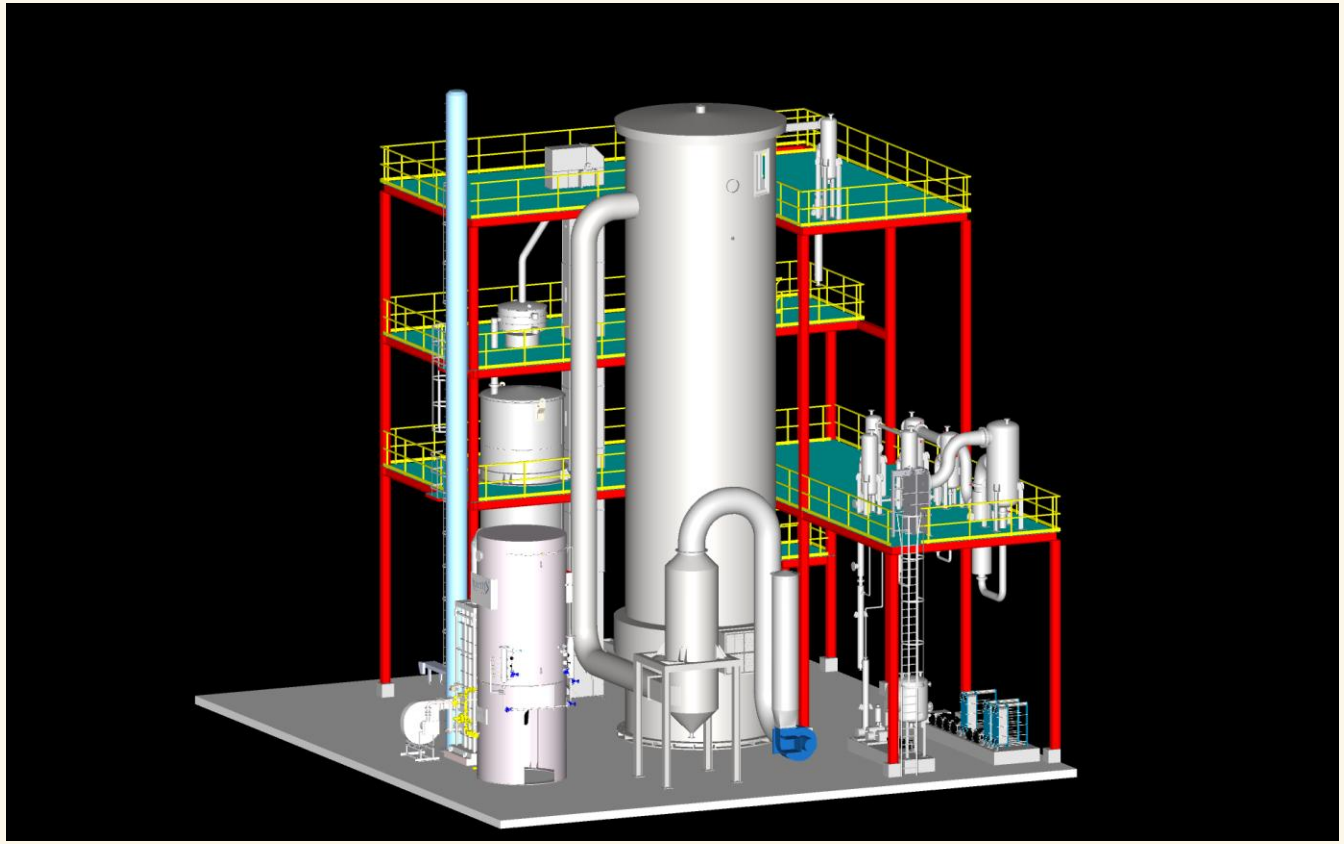
- Compact layout
- Possible to recover energy from the finisher into the before installed concentration plant (combined plant)



ExtrAlkali® - High concentration Plant

Prilling plant

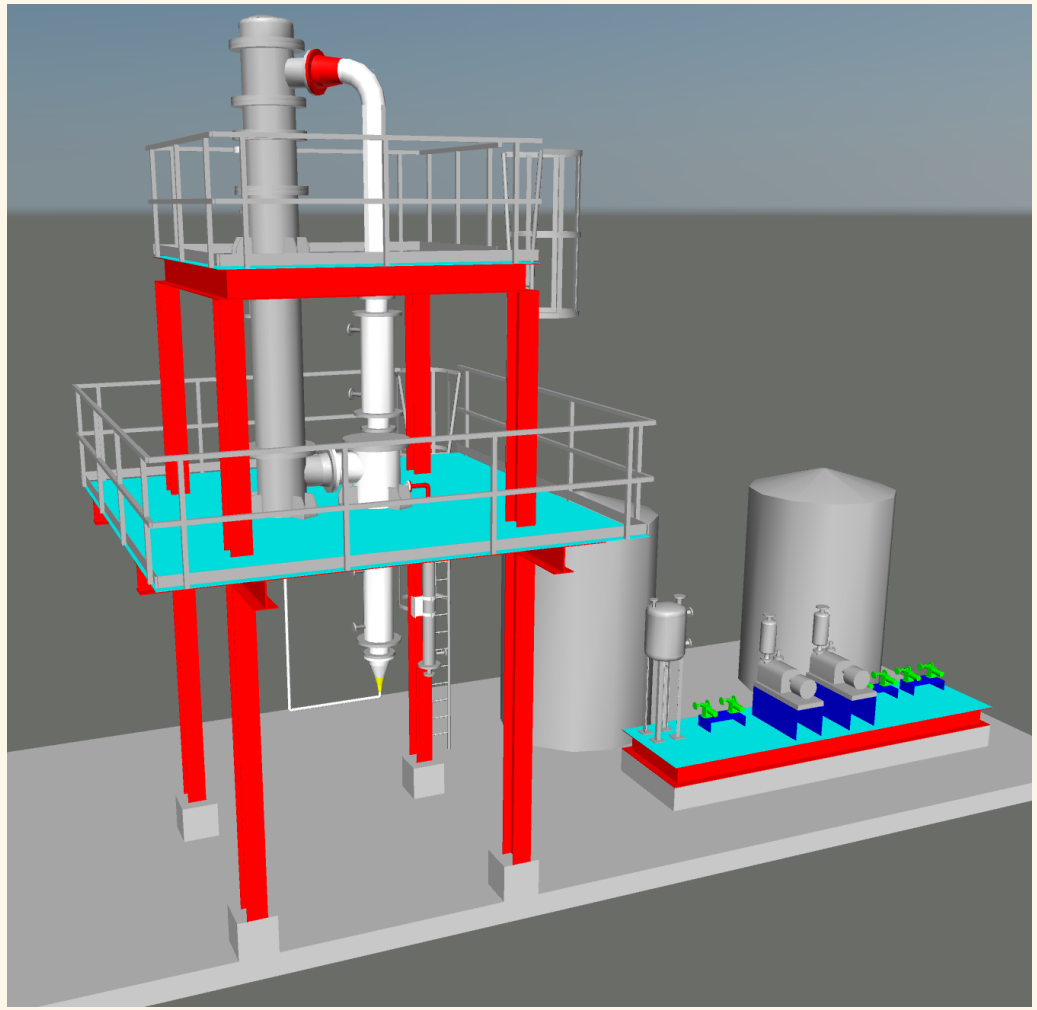
- Compact layout
- Free flowing product (NaOH prills)
- Caustic melt flows by gravity to the prilling unit (no pump)
- Prilling tower supplied by our partner



ExtrAcid® - Concentration Plant

H2SO4 concentration units

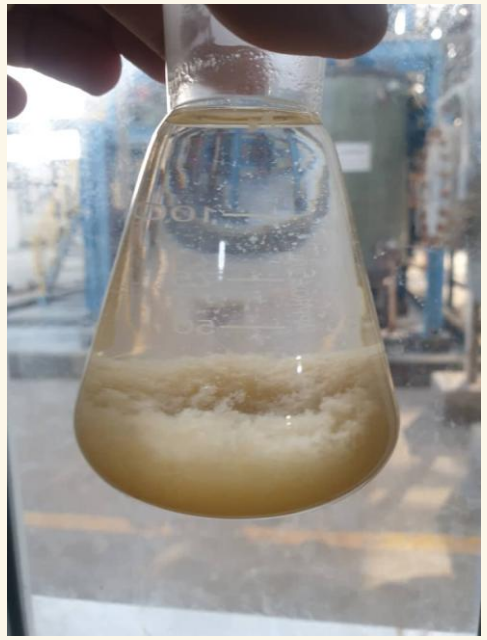
- Concentration up to **98% wt** H2SO4
- Very compact layout
- No vacuum unit
- Ideal for chlorine drying
- Electrical or oil heated



ExtrAlkali® - CaCl2 Production Plant

CaCl2 neutralization plant

- The unique solution to transform HCl into a valuable product. Our process requires very less equipment and guarantees excellent product quality.



ExtrAlkali® - CaCl2 Production Plant

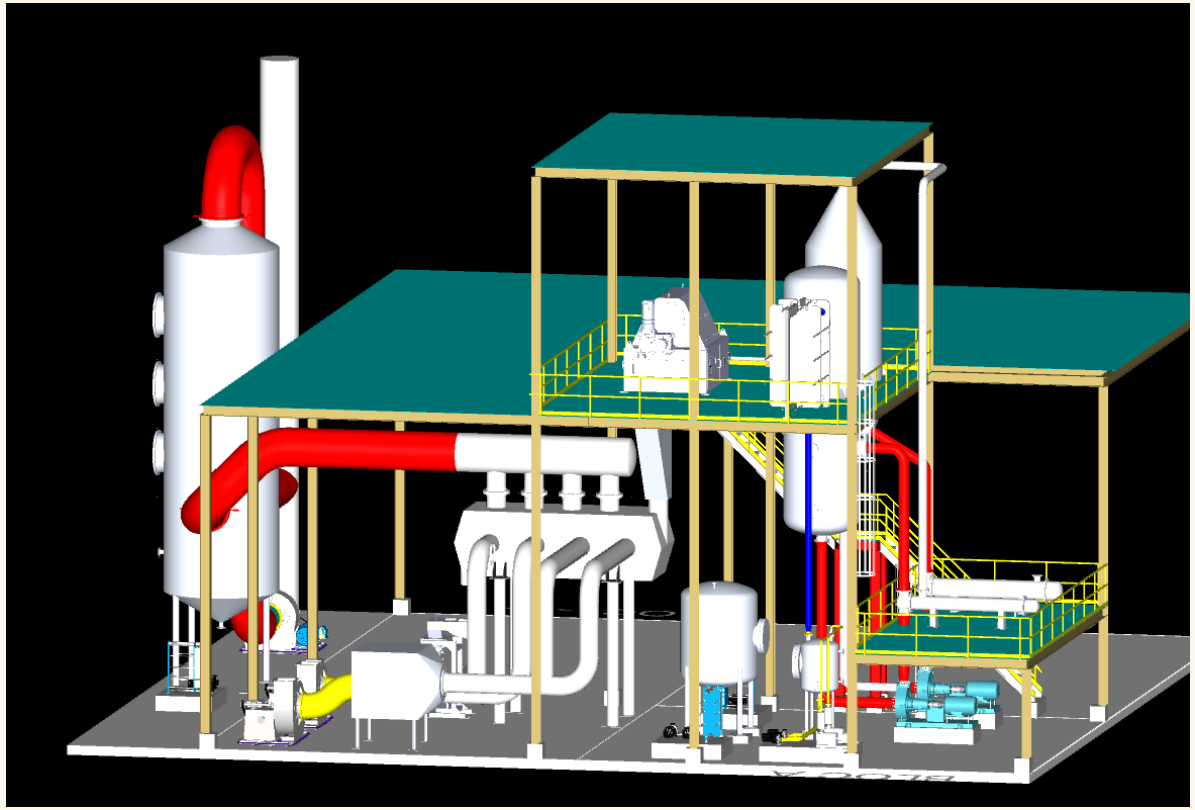
CaCl2 granulation plant

- The unique technology concept of our partner allows to produce high quality Calcium Chloride suitable for technical, feed and food applications. Their technology offers its industrial customers granulated through a smart, safe and reliable end-to-end process with more than twenty-five years of knowledge and experience in the Calcium Chloride industry.

ExtrAlkali® - CaCl2 Production Plant

CaCl2 flaking plant

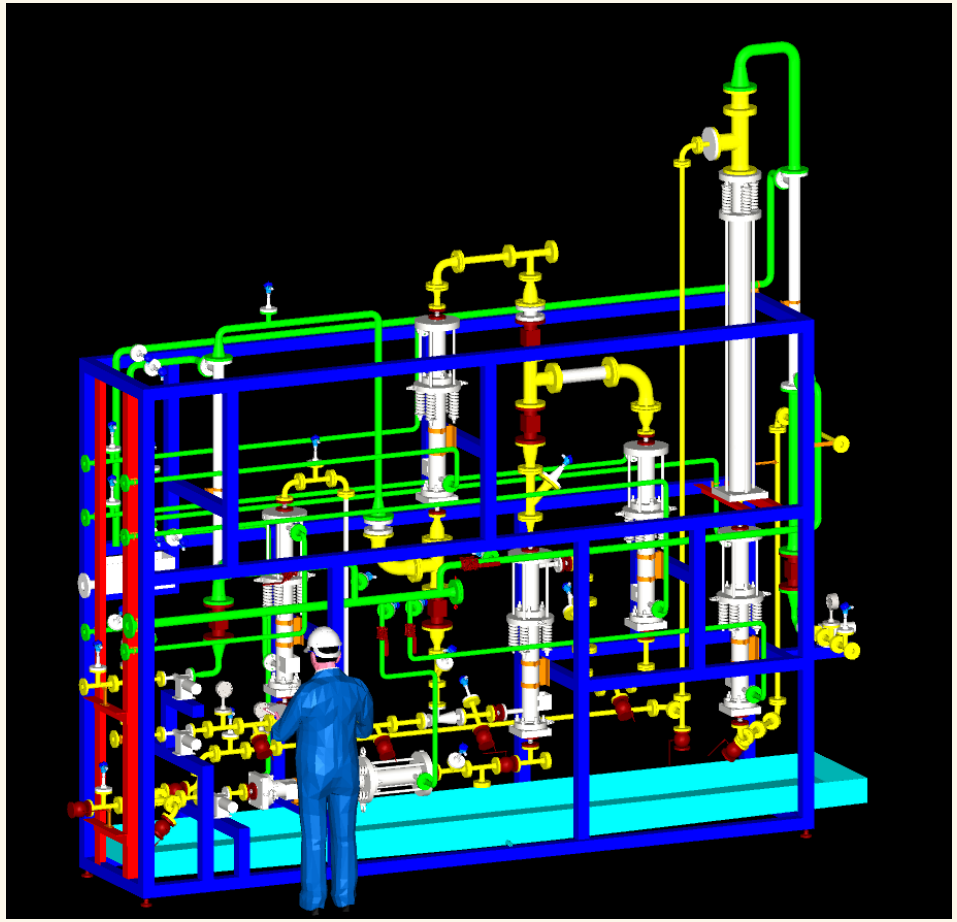
- Flaking plant for producing flakes up to 96…98% to solid CaCl2
- Flaking machine and dryer are supplied by partners



Pilot plant

NaOH, KOH, H2SO4, HCl, HF and much more !

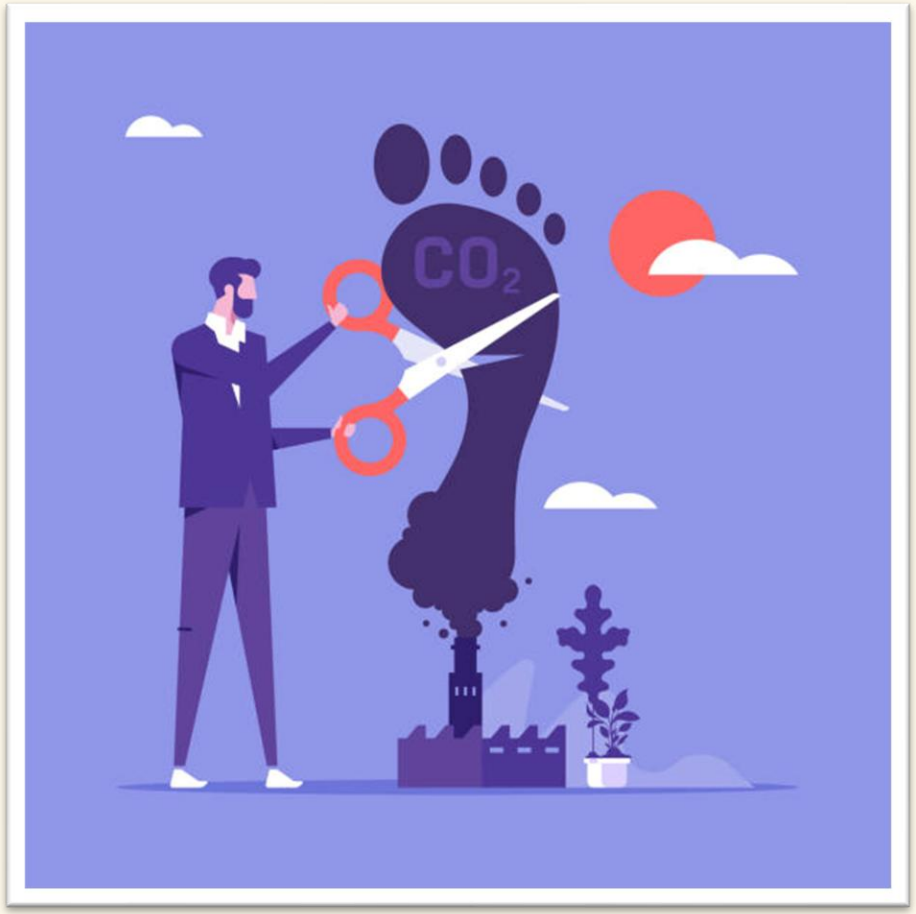
- Pilot plant located in France
- Up to 150 kg/h throughput
- Fully resistant to corrosion
- Just plug !



Conclusion

Wilk-Graphite, your partner for corrosive applications

- Single equipment such as heat exchangers or evaporators including process engineering
- Concentration systems with our sister company Extrasys
- Unique solutions for concentrating acid or caustic solution with very low energy consumption and CO2 emissions
- Typically ROI less than 2…3 years
- Wilk Graphite helps the Chlor-Alkali industry to become CO2 neutral and provide a good future for the next generations.



THANK YOU

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Chlor-alkali: achieving climate neutrality