K-UTEC AG Salt Technologies | Sondershausen | Germany

OPTIONS FOR SOP PRODUCTION

August 2022 | ACHEMA 2022

K-UTEC SALT TECHNOLOGIES

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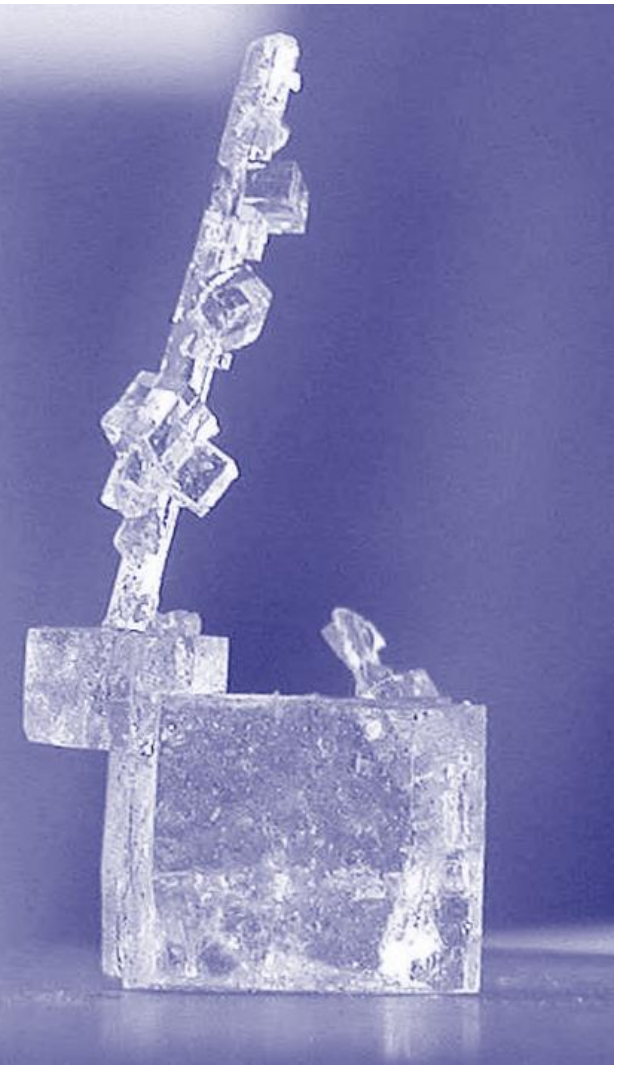
Competence in Salt

Foundation of Potash Research Institute of GDR	1951
Foundation of K-UTEC GmbH	1992
Spin-off of K-UTEC AG Salt Technologies	2008
Management Board	Dr Heiner Marx Dr Markus Pfänder Dr Sebastian Lüning
Employees	approx. 100

K-UTEC AG SALT TECHNOLOGIES

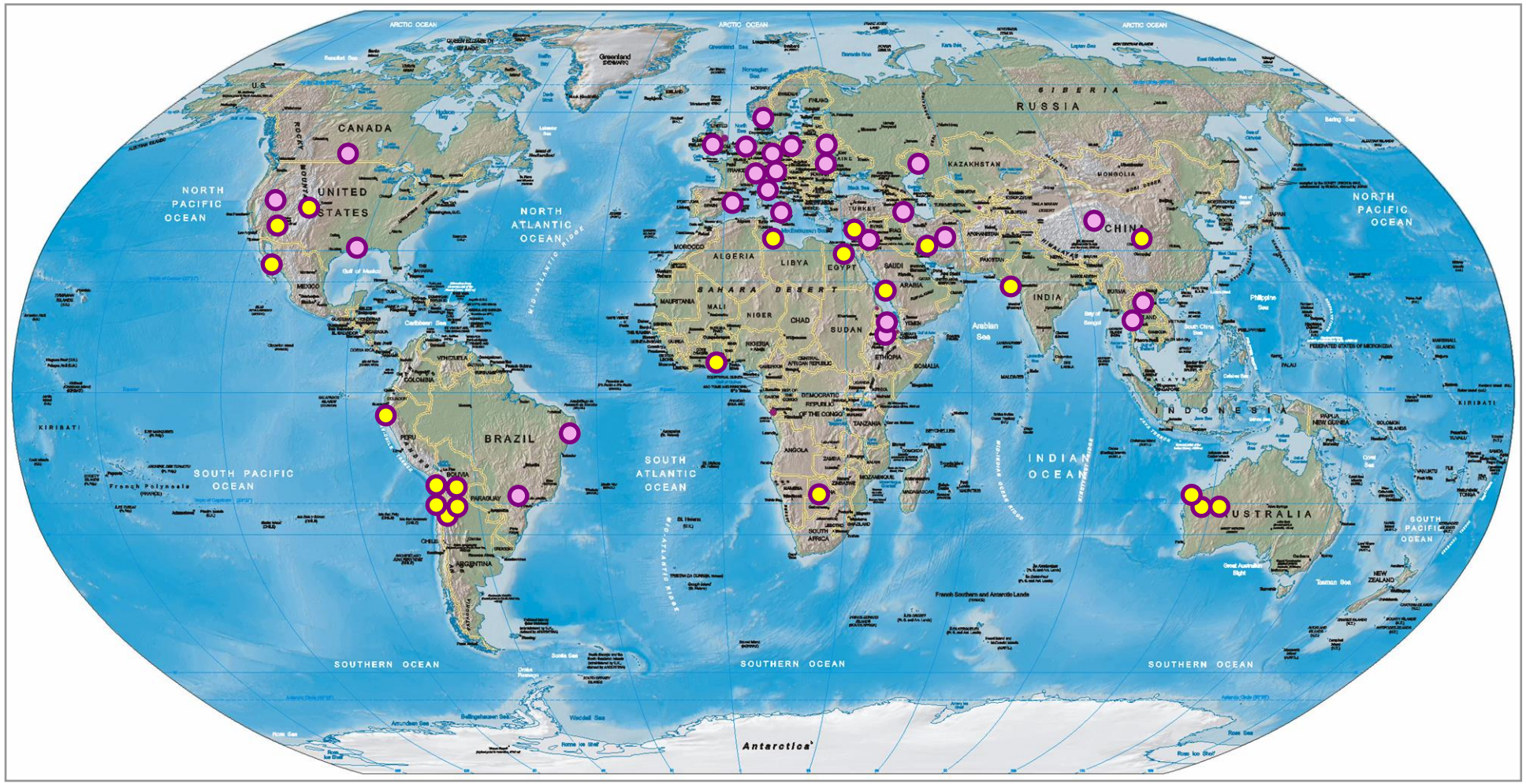
7 Decades Experience in Mineral Salt Industry



K-UTEC AG SALT TECHNOLOGIES

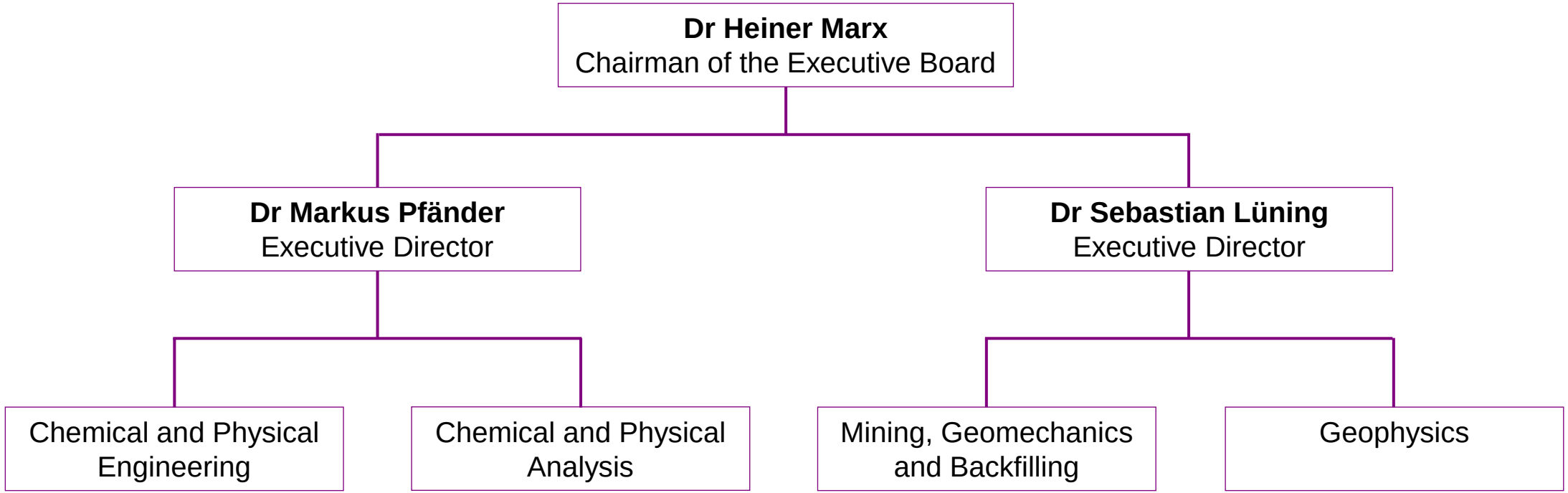
Projects Worldwide

Australia
Argentina
Austria
Belarus
Bolivia
Botswana
Brazil
Chile
China
Egypt
Eritrea
Ethiopia
France
Ghana
Hungary
India
Iran
Laos
Mexico
Peru
Russia
Saudi Arabia
Spain
Thailand
Tunisia
United Kingdom
USA



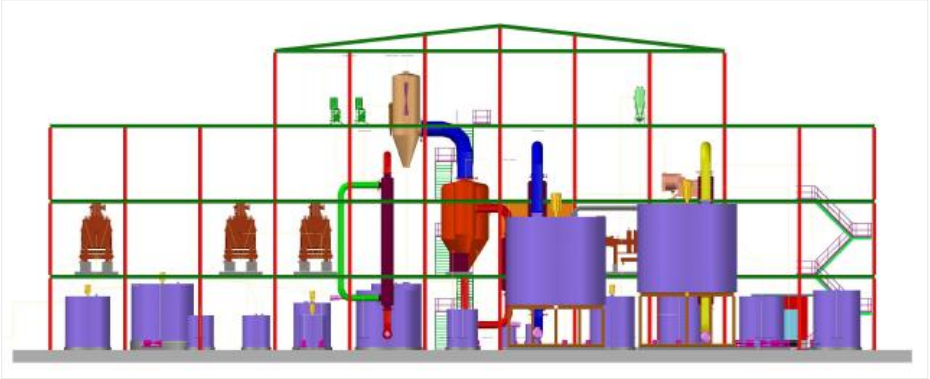
Brine deposits Solid deposits

Company Structure



Department of Chemical and Physical Engineering | Fields of Activities

- Test work in laboratory and pilot scale
- Development of process routes
- Feasibility studies and economic project evaluation
- Supply of key equipment
- Basic engineering
- Support in plant installation, commissioning and training of staff



K-UTEC AG SALT TECHNOLOGIES

Department of Chemical and Physical Engineering | Demonstration Facilities

OPTIONS FOR SOP PRODUCTION

„Mannheim Process“

SOP synthesis according to “Mannheim Process” runs in two discrete steps:

1.) $KCl + H_2SO_4 \rightarrow KHSO_4 + HCl$

2.) $KCl + KHSO_4 \rightarrow K_2SO_4 + HCl$

First step is exothermic and would theoretically proceed on ambient temperature, but the second step is endothermic and needs temperatures of 600 - 700 °C.

This process is both, capital and energy intensive and makes sense only if there is a demand for HCl.

K-UTEC’s suggestion is to avoid the high temperature process and to operate the synthesis of SOP in aqueous solution.

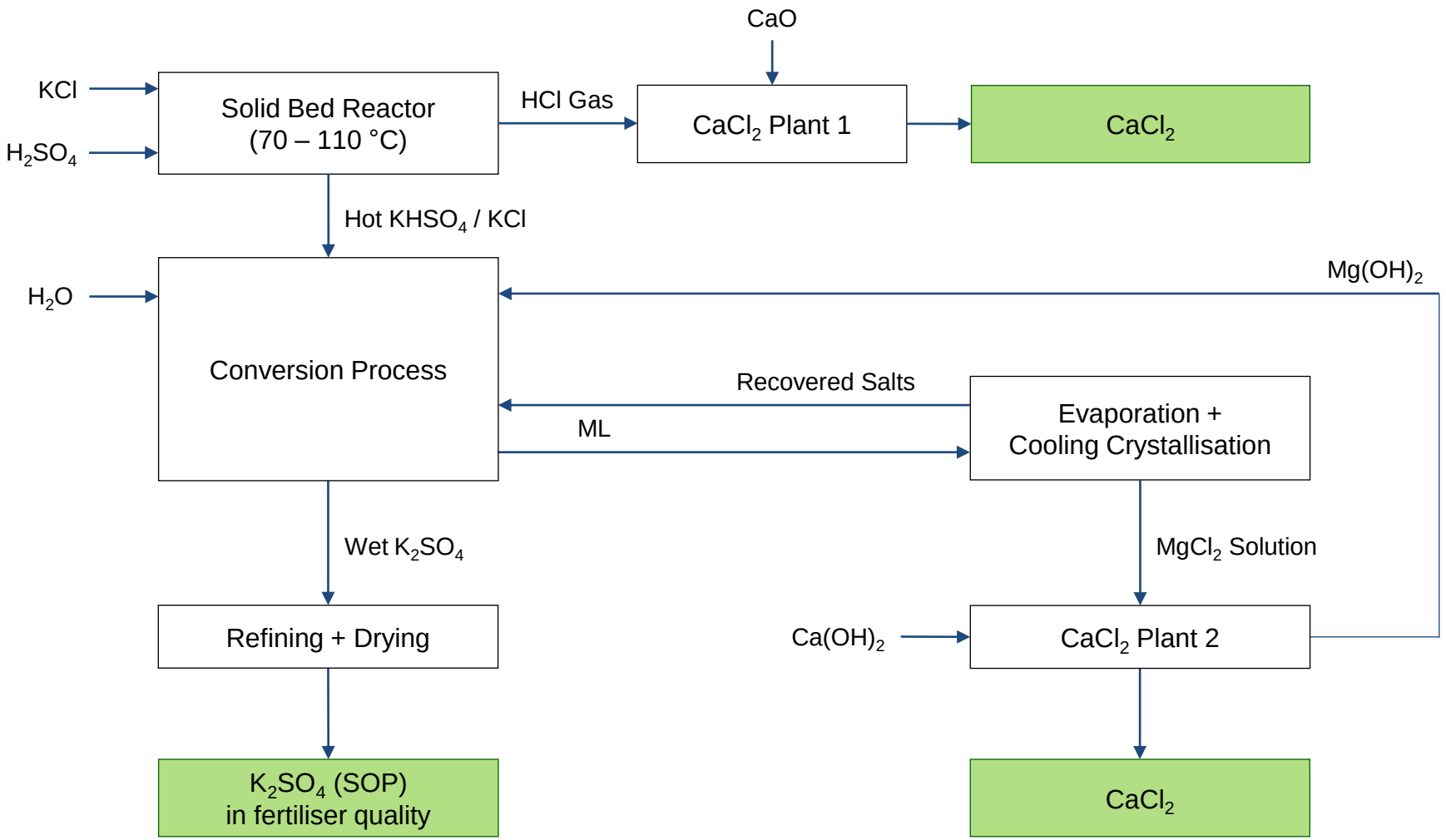
OPTIONS FOR SOP PRODUCTION

Alternatives to „Mannheim Process“

Process Alternatives		Main Process Steps	Comments
1	Production of SOP from KCl and H_2SO_4 “Modified Process”	1. Reaction of KCl with H_2SO_4 at lower temperature (70 - 100°C) in a solid bed reactor 2. Further treatment in aqueous solution	- Energy consumption is reduced - HCl output is reduced by half - $CaCl_2$ production can be done based on mother liquor
2	Production of SOP from KCl and $MgSO_4$ “Schoenite Process”	1. Conversion of KCl and $MgSO_4$ in solution at low temperatures to Schoenite 2. Conversion of Schoenite to K_2SO_4 at a temperature of about 50°C	- By-product is $MgCl_2$ - $MgCl_2$ can be used for $CaCl_2$ production using $Ca(OH)_2$; by-product is $Mg(OH)_2$
3	Production of SOP from KCl and Na_2SO_4 “Glaserite Process”	1. Conversion of KCl and Na_2SO_4 in solution at low temperature to Glaserite 2. Decomposition of Glaserite to K_2SO_4 at environmental temperature	- By-product is NaCl
4	Production of SOP from KCl and $(NH_4)_2SO_4$	1. Reaction of KCl with $(NH_4)_2SO_4$ in solution to K_2SO_4 and NH_4Cl 2. Crystallisation of K_2SO_4 by cooling	- Recovery of SOP is low, because of the solubility equilibrium - By-product is NH_4Cl - Crystallisation of a mixed product (K_2SO_4/NH_4Cl) as NK fertiliser is recommended (or production of NPK fertiliser)

OPTIONS FOR SOP PRODUCTION

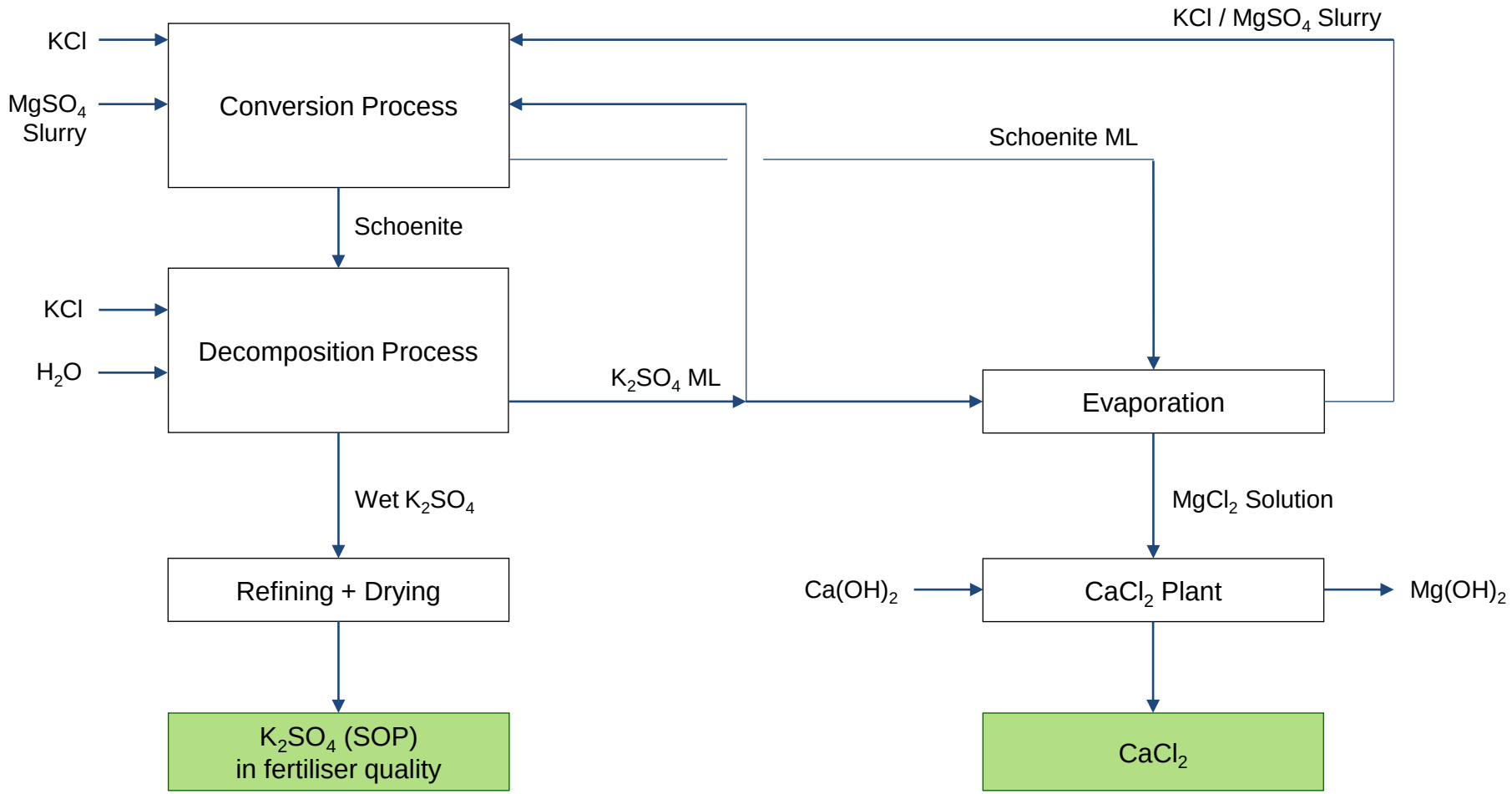
SOP production based on KCl and H_2SO_4 with reduced HCl production (Modified Process)



ML = Mother Liquor

OPTIONS FOR SOP PRODUCTION

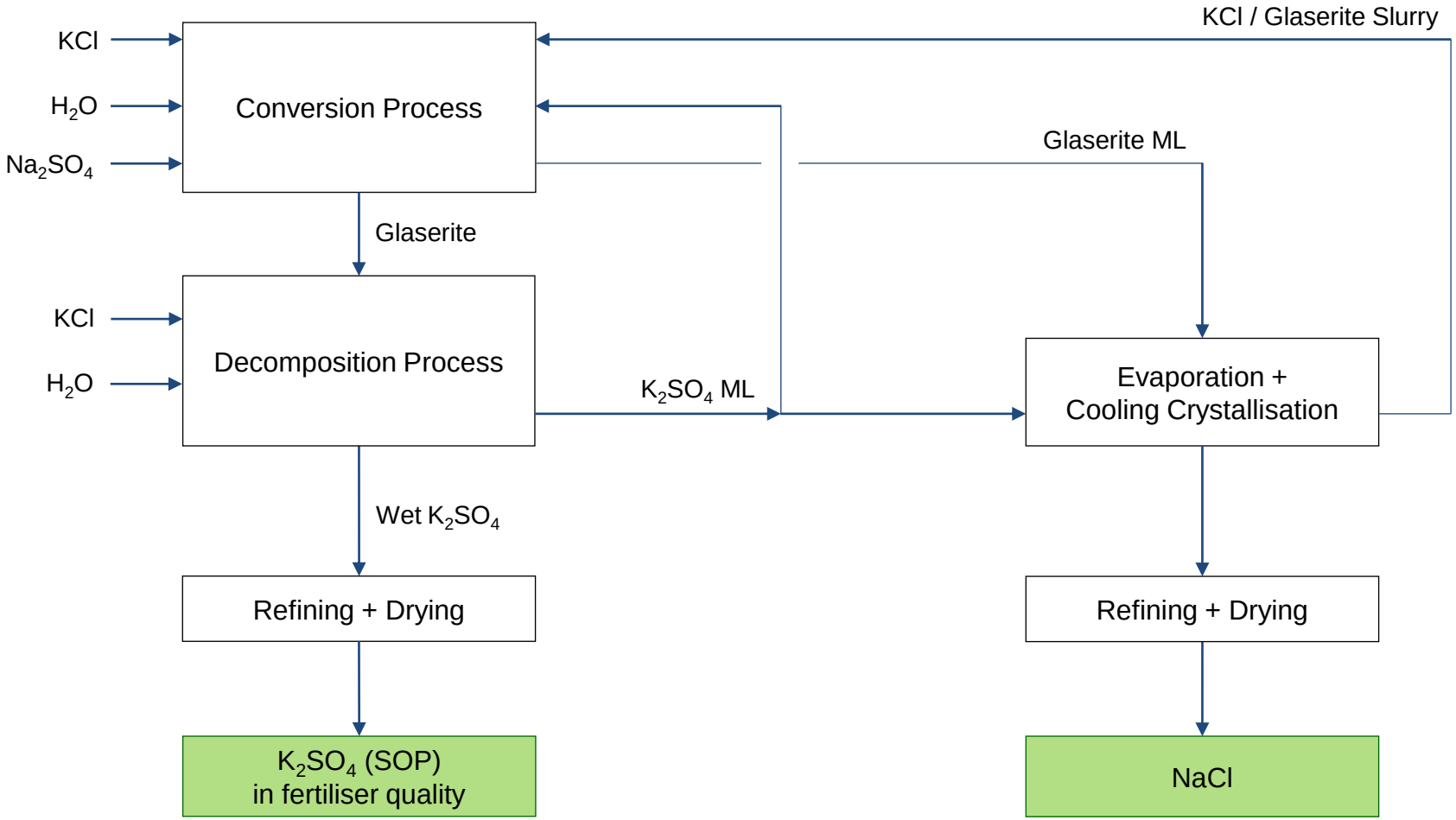
SOP production based on KCl and $MgSO_4$ (Schoenite Process)



ML = Mother Liquor

OPTIONS FOR SOP PRODUCTION

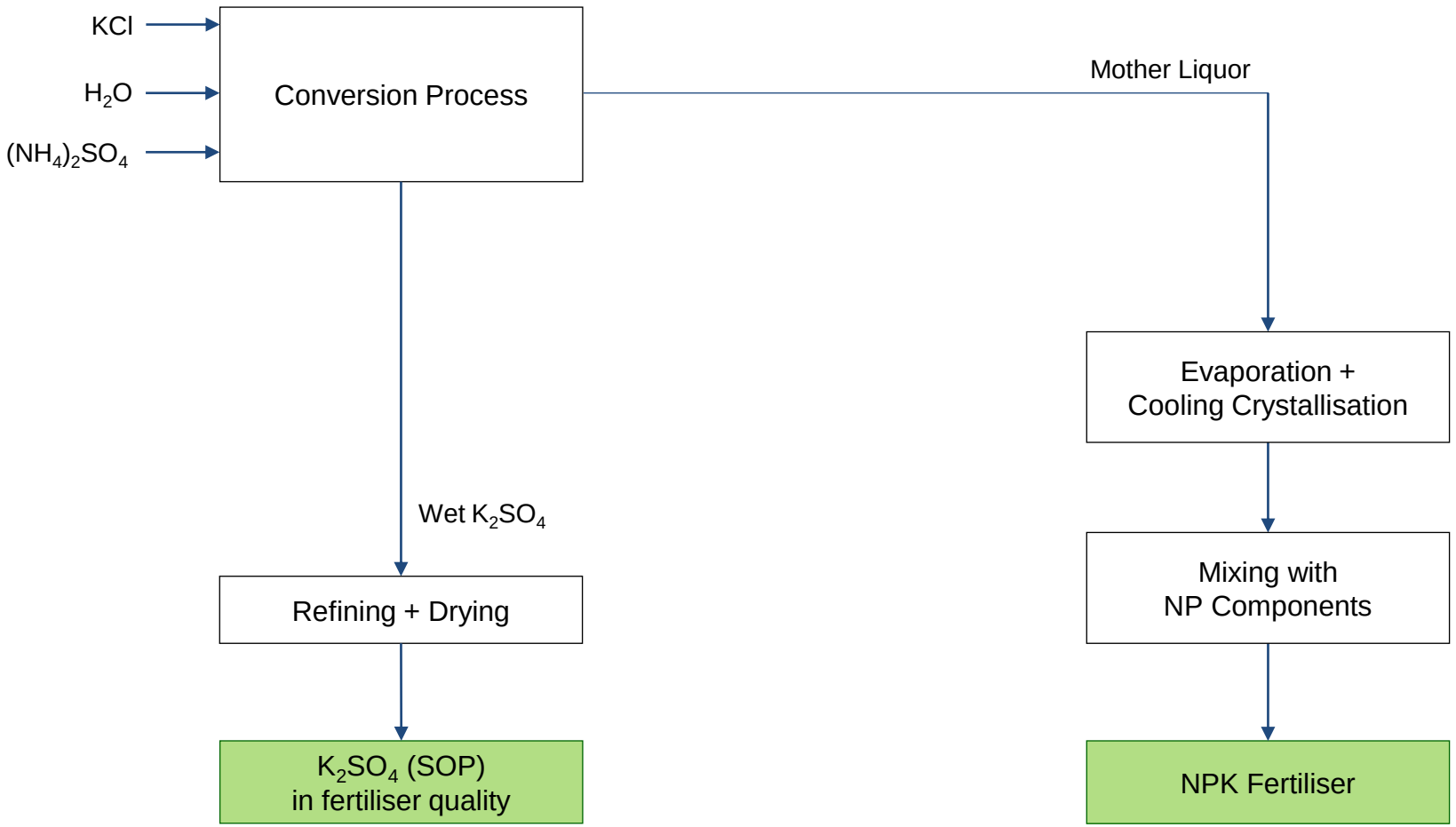
SOP production based on KCl and Na_2SO_4 (Glaserite Process)



ML = Mother Liquor

OPTIONS FOR SOP PRODUCTION

SOP production based on KCl and $(NH_4)_2SO_4$



K-UTEC‘S REFERENCES

Project Example 1

SOP via Schoenite Process

Location	Runn of Kutch, India
Resource	Bittern resulting from sea salt production
Capacity SOP (K_2SO_4)	100,000 tpa

K-UTEC‘s Scope

Test Work

Process Design

Basic Engineering

Partial Detailed Engineering

Support in Commissioning (2015)

K-UTEC‘S REFERENCES

Project Example 2

SOP via Schoenite Process

Location	Beyondie Lake, Australia
Resource	Natural Brine
Capacity SOP (K_2SO_4)	90,000 tpa

K-UTEC‘s Scope

Test Work

Process Design and Basic Engineering

Detailed Engineering for the Process Plant

Procurement and Supply of Key Components

Support in Commissioning (2021)

K-UTEC‘S REFERENCES

Project Example 2

Commissioning since 2021

Project Example 3

SOP via Glaserite Process

Location	Ebensee, Austria
Resource	KCl containing effluent brine
Capacity SOP (K_2SO_4)	20,000 tpa
Capacity NaCl	60,000 tpa

K-UTEC‘s Scope

Test Work

Process Design and Basic Engineering

Partial Detailed Engineering

Support in Commissioning

Plant in Operation since 2006

Capacity Enhancement since 2014

7-stage cooling crystallisation of Glaserite

SOP conversion reactor

Circulation pumps

Evaporation / NaCl crystallisation

SOP centrifuges

THANK YOU

K-UTEC AG Salt Technologies | Sondershausen | Germany

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