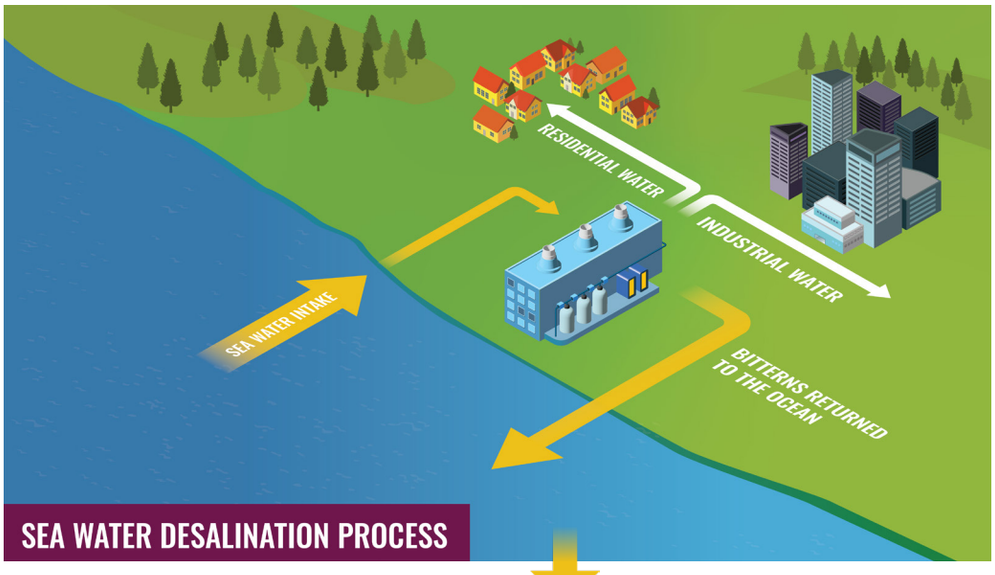
K-UTEC SALT TECHNOLOGIES

Unlocking New Value from Seawater Desalination Bitterns

Global seawater desalination supplies nearly 100 million m³ of fresh water per day but also produces even more concentrated brine that are discharged back to the ocean.

Seawater desalination plants convert seawater into potable and industrial water through membrane and thermal processes. For every unit of fresh water produced, a larger volume of concentrated saline brine (commonly referred to as bitterns) is generated and typically discharged back to the ocean.



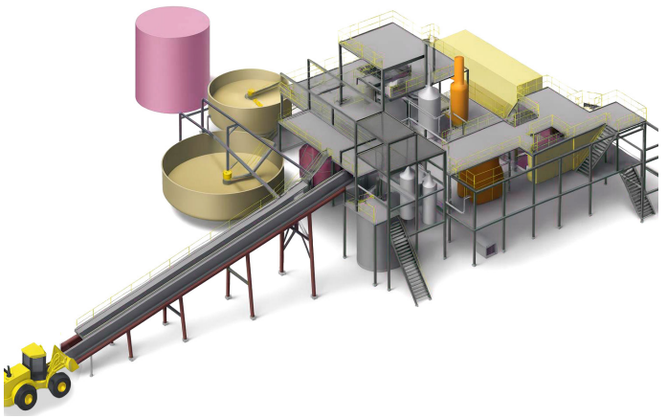
This “waste”/unused bitterns stream is naturally rich in potassium, sulphate, magnesium, and other valuable minerals.

K-UTEC’s patented Schoenite process can recover Sulphate of Potash (SOP) from these bitterns.

**Patent DE102009018956B4*

A powerful circular-economy opportunity exists right here!

SEA WATER TO FERTILISER



/ Unlock SOP Production from Seawater Desalination Bitterns

Seawater desalination plants produce fresh water while generating concentrated saline brine (bitterns). Through solar evaporation these bitterns can be converted into solar sea salt, producing sodium chloride (NaCl) and a potassium- and magnesium-rich residual brine.

This secondary bitterns stream from the solar sea salt production is directly suitable for conversion into premium Sulphate of Potash (SOP) and other by-products using K-UTEC's proven, low-impact, high-efficiency process design, allowing operators to generate new revenue, boost asset productivity and strengthen ESG performance.

With global SOP demand rising, it's a timely way to diversify using seawater as the original feedstock.

/ SOP: High-Value Potassium for High-Value Crops

SOP (K_2SO_4) is a premium potassium fertiliser used in high-value agriculture. It delivers essential potassium without added chloride, making it ideal for crops that are salt-sensitive or grown in saline-prone soils.

- **Chloride-Free Advantage:** SOP contains virtually no chloride, unlike MOP (Muriate of Potash), which makes it suitable for delicate crops.
- **Premium Crop Performance:** Enhances plant quality, boosts disease resistance, and improves taste, colour, and shelf life.
- **ESG-Aligned Product:** SOP supports sustainable farming by reducing salinity risk and improving soil health.
- **Target Crops:** Commonly used on grapes, berries, citrus, avocados, coffee, tea, tobacco, leafy greens, and flowers.
- **Higher Market Value:** Commands a price premium over MOP due to its crop-specific value and lower environmental impact.

/ Commercial Drivers

K-UTEC's low-capex, modular solution helps operators improve site efficiency and expand market reach.

- Recovering untapped bitterns currently discharged as waste
- Enabling access to the high-margin SOP market
- Enhancing ESG performance through reduced discharge, optimised resource use, and a low-carbon process
- Providing strategic differentiation for producers offering both industrial and agricultural-grade products

/ Potential Business Models

Salt producers can engage through several models:

- **Feedstock Supply:** Provide NaCl and potassium-rich bitterns to a developer for NaCl and SOP production under long-term offtake agreements.
- **Joint or Co-Located Development:** Partner with an independent developer to share infrastructure and investment risk.
- **Fully Integrated Operation:** Build and operate an on-site SOP plant for full control and market access.

/ K-UTEC Credentials

- Decades of leadership in salt, potash, and brine processing, from feasibility to production.
- Trusted partner on global SOP projects, including pilot plant design, process optimisation, and start-up support.
- Process development including bench and pilot scale testing
- ISO 9001-certified QA; in-house ISO 17025-accredited analytics.
- Global project footprint across industrial brines and salt waste streams, with deep integration experience.



/ Proven NaCl and SOP Processes, Tailored for Seawater Desalination Bitterns

K-UTEC's NaCl and SOP-from-bitterns processes apply a refined process design, adapted for brines originating from seawater desalination.

The processes have been validated through pilot testing and process verification and is engineered for efficient integration with both desalination infrastructure and downstream solar salt operations.

/ Core Process Steps

NaCl and SOP production from seawater desalination bitterns follow a staged process, beginning with sodium chloride recovery via solar evaporation and a salt wash plant, followed by proven SOP conversion steps from potassium-rich bitterns:

- **Desalination Brine Management and Solar NaCl Recovery:** Concentrated brine from seawater desalination is directed to solar evaporation ponds to recover sodium chloride (NaCl), producing quality, saleable NaCl and potassium- and magnesium-rich bitterns equivalent to those generated by conventional solar sea salt operations.
- **Bitterns Pre-Concentration, Kainite Type Mixed Salt (KTMS) Crystallisation and KTMS Harvesting**
- **Conversion:** Crushed or slurried KTMS reacts with recirculated liquor to form potassium/magnesium sulphates and separate NaCl.
- **Flotation/Recrystallisation and Purification:** Converted salts undergo flotation or recrystallisation to remove halite and boost yield.
- **SOP Recovery and Purification:** Recovered schoenite is washed to remove impurities, leaving SOP solids ready for drying.
- **Drying and Granulation:** The final SOP is dried and granulated to premium standards, ready for bagged or bulk export.

/ Estimated Consumption Metrics

Baseline 1m³ of sea water stream.

Product Stream	Basis	Ratio	Unit
Fresh Water	per m³ sea water	0.42-0.45	m³/m³
Desalination bittern to ponds	per m³ sea water	0.55-0.58	m³/m³
NaCl (HG)	per m³ sea water	0.022	t/m³
NaCl (LG)	per m³ sea water	0.002	t/m³
Sea Salt Bittern	per m³ sea water	0.08-0.13	m³/m³

1 ton NaCl production requires approx. 42 m³ of sea water.

Product Stream	Basis	Ratio	Unit
Primary KTMS	per t of NaCl	0.18	t/t
Primary End Bittern	per t of NaCl	0.46	m³/t
SOP from prim. KTMS	per t of NaCl	0.02	t/t
SOP from sec. KTMS	per t of NaCl	0.01	t/t
SUM of SOP	per t of NaCl	0.03	t/t
Secondary End Bitterns	per t of NaCl	0.1	m³/t

Figures reflect a process configuration optimised for low energy input, low emissions, and minimal freshwater consumption.

/ Utility & Infrastructure Requirements

The SOP plant requires a stable and modest utility setup:

Power

A reliable power supply is essential, and some sites may need upgrades to existing electrical infrastructure.

Steam

Low-pressure steam supports drying, washing, and granulation, with compact containerised boilers typically sufficient.

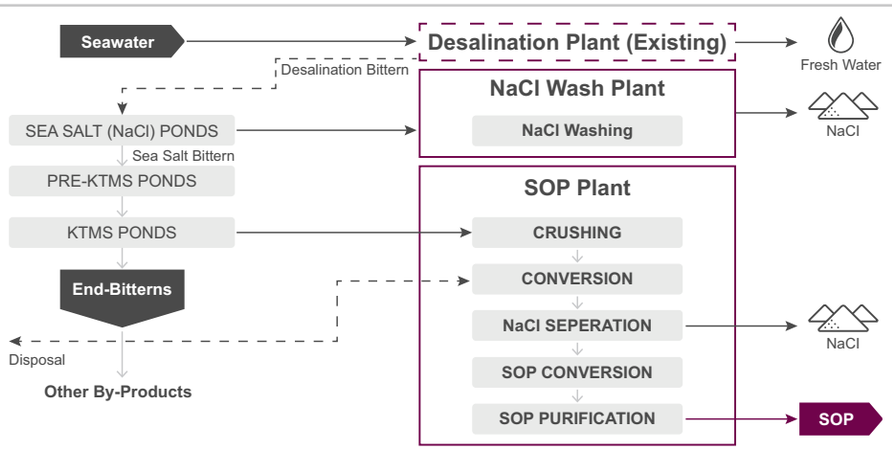
Water

Fresh water use is minimal and focused on essential washing, with optimised circuits & condensate recovery to reduce demand.

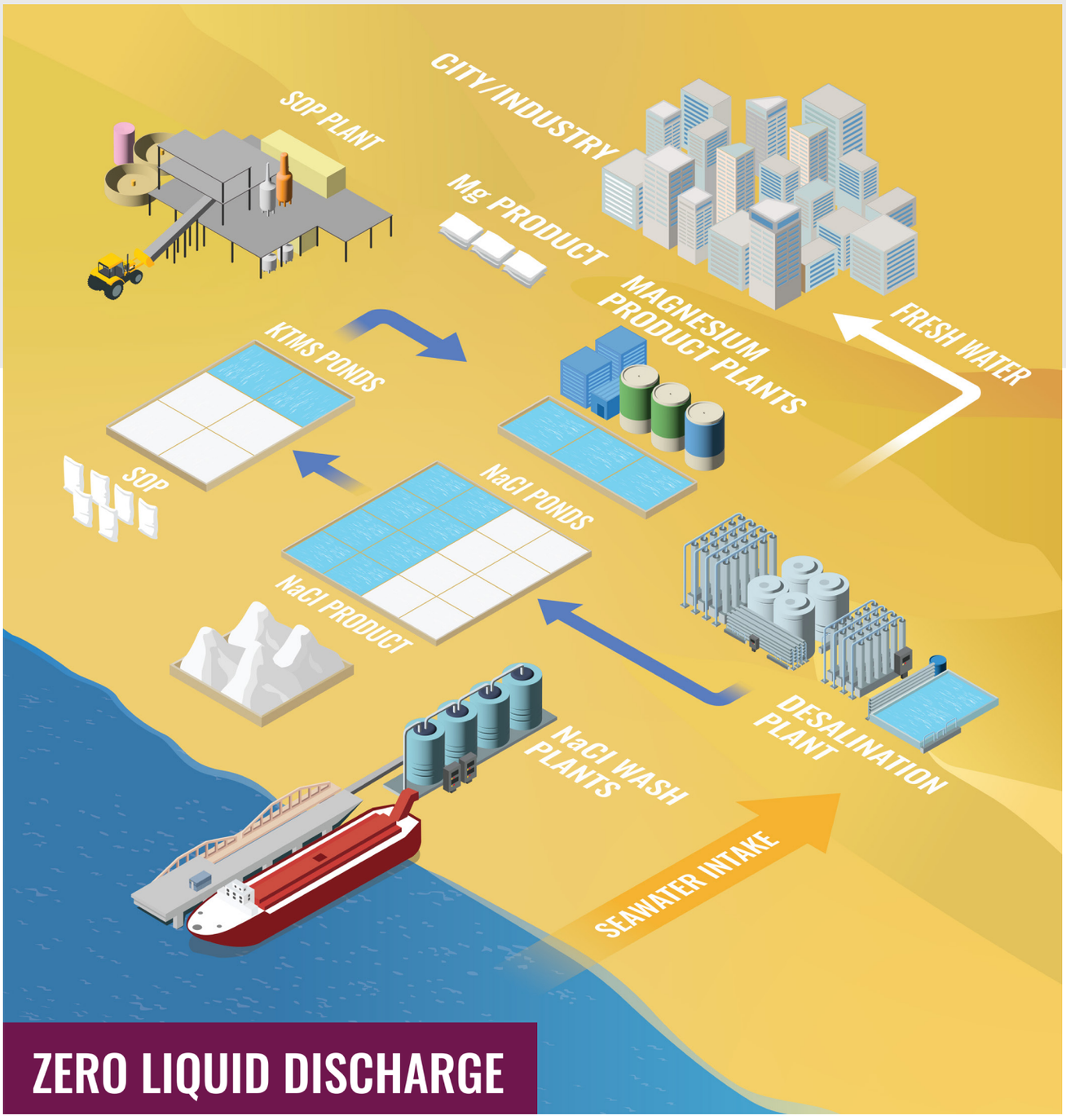
Cold & Chilled Water

Conversion temperatures are controlled via heat exchangers and closed-loop systems, boosting efficiency and reducing carbon footprint.

/ NaCl & SOP Production From Desalination



From Seawater Desalination Brine To A Multi-Product "Zero Liquid Discharge" System



Maximum renewable resource efficiency.
Multiple revenue streams. Minimal discharge.