

Lithium Solutions

High-end technologies and professional services for Lithium salts and battery recycling

The world demand for lithium continues to grow to address the increasing use of lithium ion batteries in hybrid and electrical vehicles, energy storage systems, and high-drain portable electronics.

To cater to growing worldwide lithium demand, KBR offers high-end Ecoplanning technologies, full life-cycle professional/technical services and project delivery for lithium chemicals production from salar brines and ores. KBR also offers unique expertise for lithium battery recycling plants for Ni, Co, Mn and Li recovery. Additionally, KBR offers Plinke technologies for recovery of inorganic acids like H_2SO_4 , HCl , HNO_3 , HF and removal of impurities.

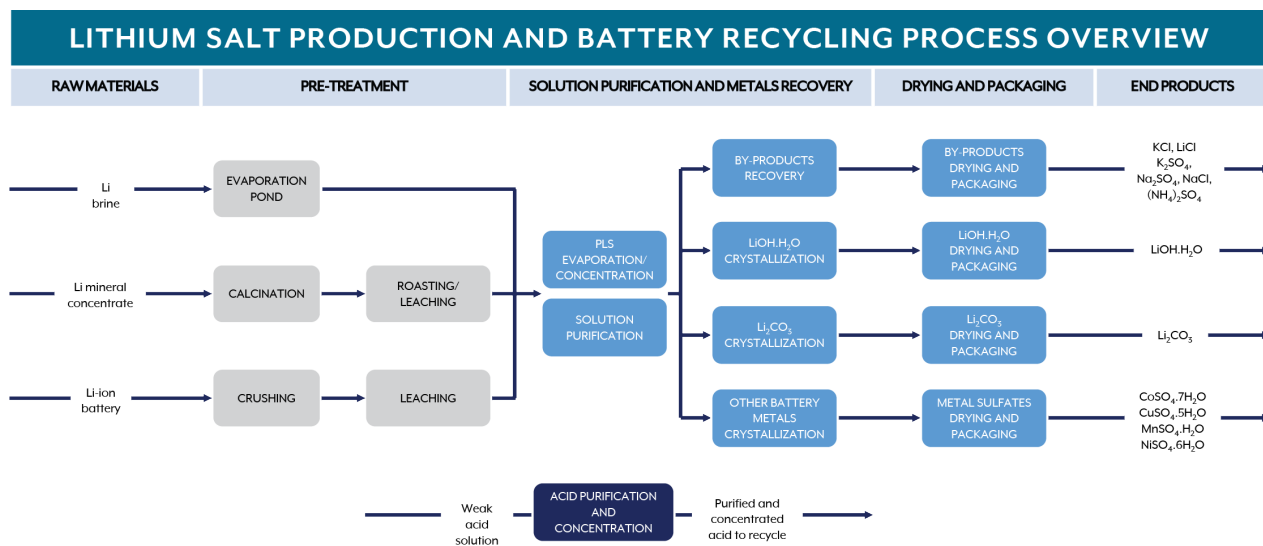
Our processes are customized and optimized for specific feedstock, capacity, environmental needs and quality specifications to best suit the specific demands of a customer.

KBR offers technical expertise for all of the lithium chemicals production processes highlighted blue in the diagram below.

Multi - dimensional capabilities across the entire Lithium value chain

KBR's capabilities spanning the lithium value chain include:

- Scoping and feasibility studies
- Process flowsheet evaluation and optimization
- Test work (bench scale batch and piloting)
- Basic engineering
- Detailed engineering
- Proprietary equipment
- Project delivery
- Training
- Installation
- Turn-key supply
- PMC
- Commissioning and start-up
- Operations and maintenance support
- Technical services and equipment spare parts



WATER BALANCE AND IMPURITIES MANAGEMENT



Reliability
Low Carbon footprint

Energy efficient
Optimized operation

Commercially proven and robust equipment for Lithium and energy metals processes

KBR offers a multitude of well-proven proprietary equipment for evaporation, crystallization and solid handling.

Evaporation

- Falling film evaporators
- Forced circulation evaporators
- Rising film evaporators
- Vapor recompression techniques (TVR, MVR)

Crystallization

- Forced circulation crystallizers
- Vacuum draft tube crystallizers
- Vacuum draft tube baffle crystallizers
- Evaporative cooling crystallizers
- Surface cooling crystallizers

Solid Handling

- Thickeners and hydrocyclones
- Filters and centrifuges
- Fluidized bed dryers
- Dust handling
- Packaging and handling

Research & development

KBR continuously strives to innovate to design optimal processes that offer high efficiency, reliability and performance. Key to its research endeavors are its testing and pilot plant facilities that help judge the suitability and commercial viability of new and promising technologies it develops.



**Mobile pilot
evaporator/Crystallizer**



**KBR Ecoplanning's
test work facility**

Modularized units and equipment

The remote location of lithium reserves makes the development of processing plants for lithium chemicals logistically and strategically challenging, which calls for modularization of process units.

A modular approach to a lithium project offers significant advantages compared to conventional stick-built, on-site construction:

- Lower capital cost and labor requirement
- Quicker payback
- Accelerated schedule
- Lower risk; better HSSE performance
- Enhanced quality – Modules are carefully crafted and thoroughly tested before delivery

KBR has designated modularization departments in Houston and India that specialize in design, manufacture and supply of modular projects.

KBR - Your process specialist

KBR has a long, rich history of creating value for our clients, with more than 50 years of service in evaporation and crystallization processes and hundreds of satisfied clients. KBR has supplied over 200 Ecoplanning evaporation and crystallization processes for various applications and techniques all over the world.

For the lithium industry, KBR offers complete solutions ranging from evaporators, crystallizers, dryers, centrifuges and associated equipment as well as packing of final product.

References

PLS Evaporator



- Caustic soda concentration plant in Sweden
- Capacity - 50 - 1500 TPD as 100% sodium hydroxide (NaOH)
- Technology - Processes with shell & tube falling film evaporator

Crystallizer



- Sodium sulfate crystallization unit in Indonesia
- Capacity - Crystallization: 32 t/h;
Water evaporation: 120 t/h
- Technology - Forced circulation evaporation crystallizer

Recent Lithium Reference

KBR is implementing its evaporation and crystallization technology solutions at the Tres Quebradas ("3Q Project") Lithium Project by Neo Lithium Corp. in Argentina (now LiEx S.A, owned by Zijin group) to ensure the project achieves maximum lithium yields for Zijin group's battery-grade lithium carbonate production.

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