

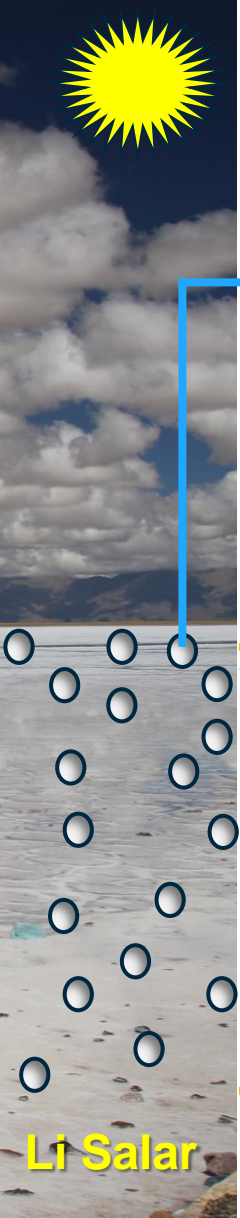
TBT Lithium Recovery Process



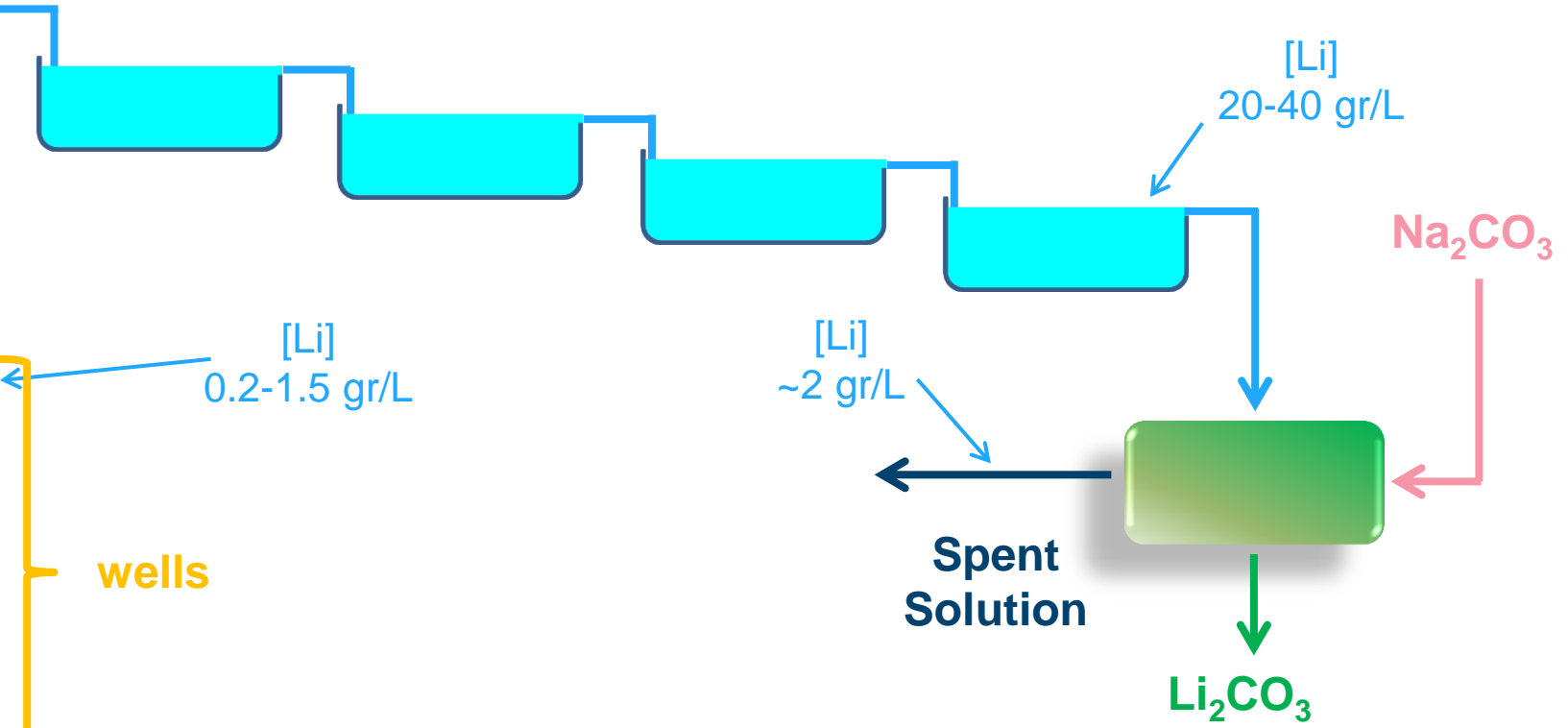
Sept , 2016



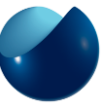
The Conventional Process



Evaporation ponds



The Process

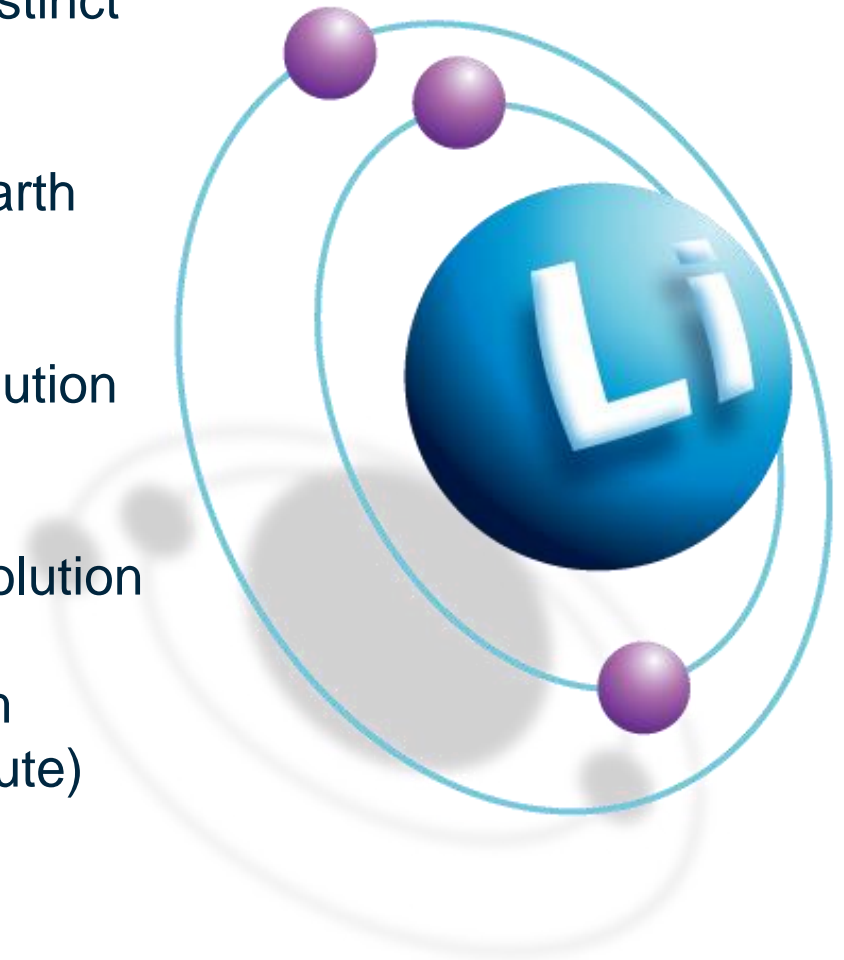


The Technology consists of three distinct processes sections:

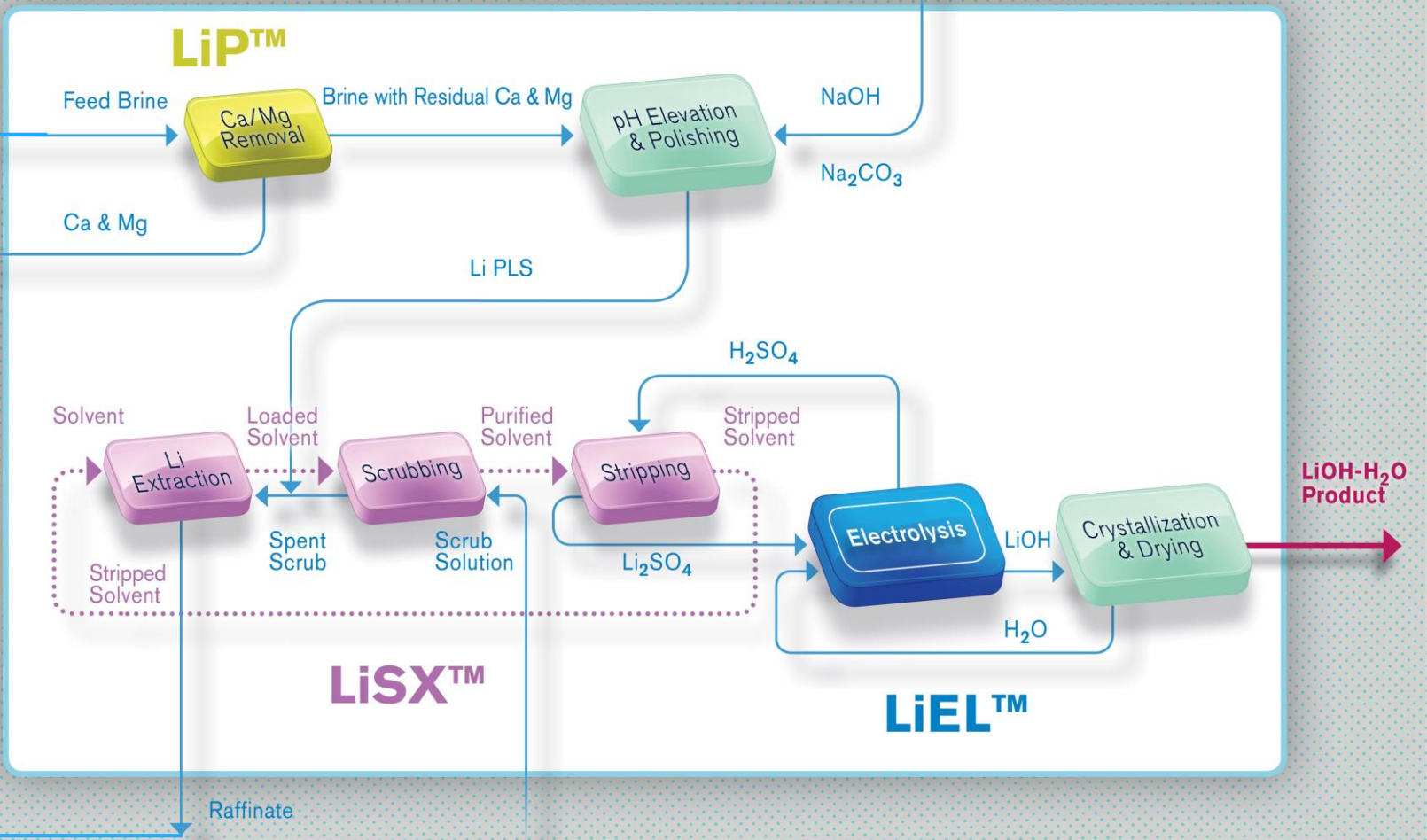
LiP™ – Physical removal of alkali earth elements, using membranes

LiSX™ - Recovery of lithium into solution utilizing solvent extraction process

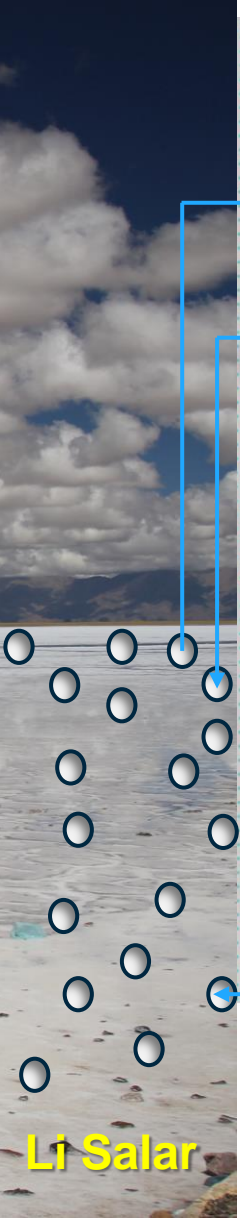
LiEL™ - conversion of the Li_2SO_4 solution into LiOH solution, using electrolysis followed by downstream crystallization (only for $\text{LiOH}\cdot\text{H}_2\text{O}$ route)



TBT's Alternative for LiOH·H₂O Production

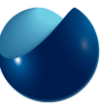


BATTERY LIMITS: TBT CLIENT



Li Salar

The Process



LiSX™ is a solvent extraction technology for lithium recovery.

The LiSX™ process is fully effective on aqueous solutions containing lithium concentrations as low as 20 ppm, with recoveries of more than 99%.

In salar operation all waste streams are suitable for reinjection into the source, eliminating any environmental impact.

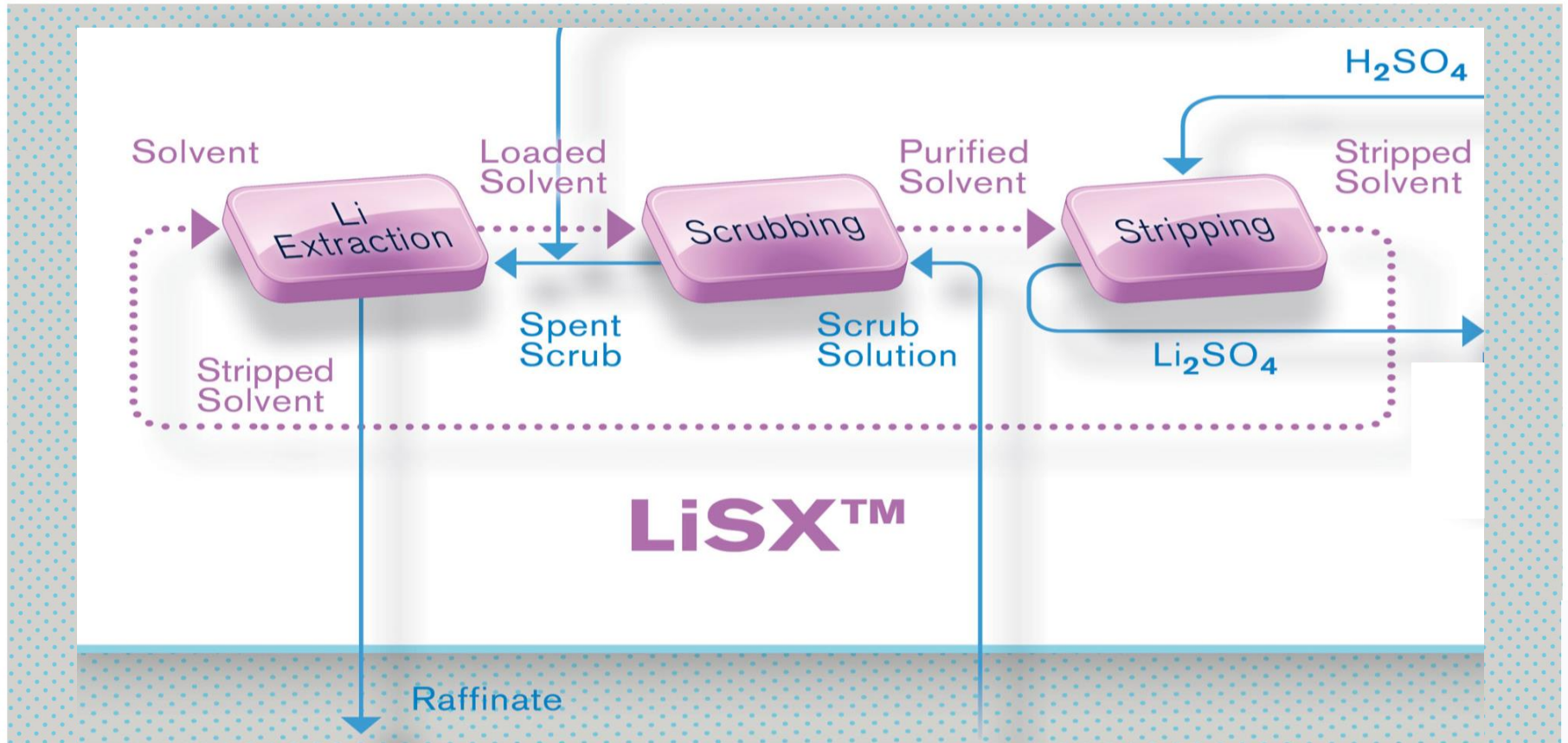
The LiSX™ process is versatile and may be rapidly reconfigured to produce different lithium end-products at exceptionally high purity.





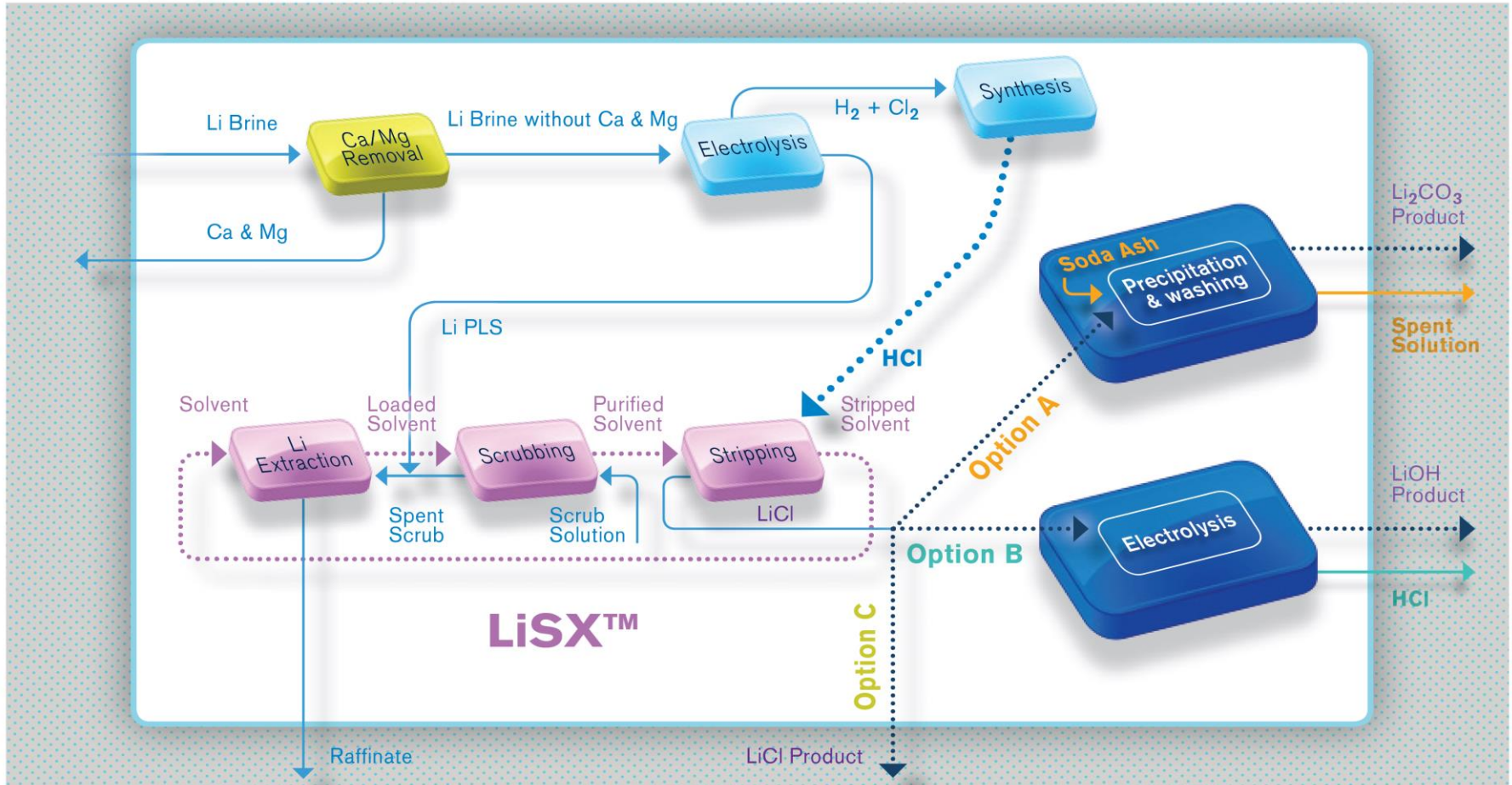
Solvent Extraction

The Heart of the Process





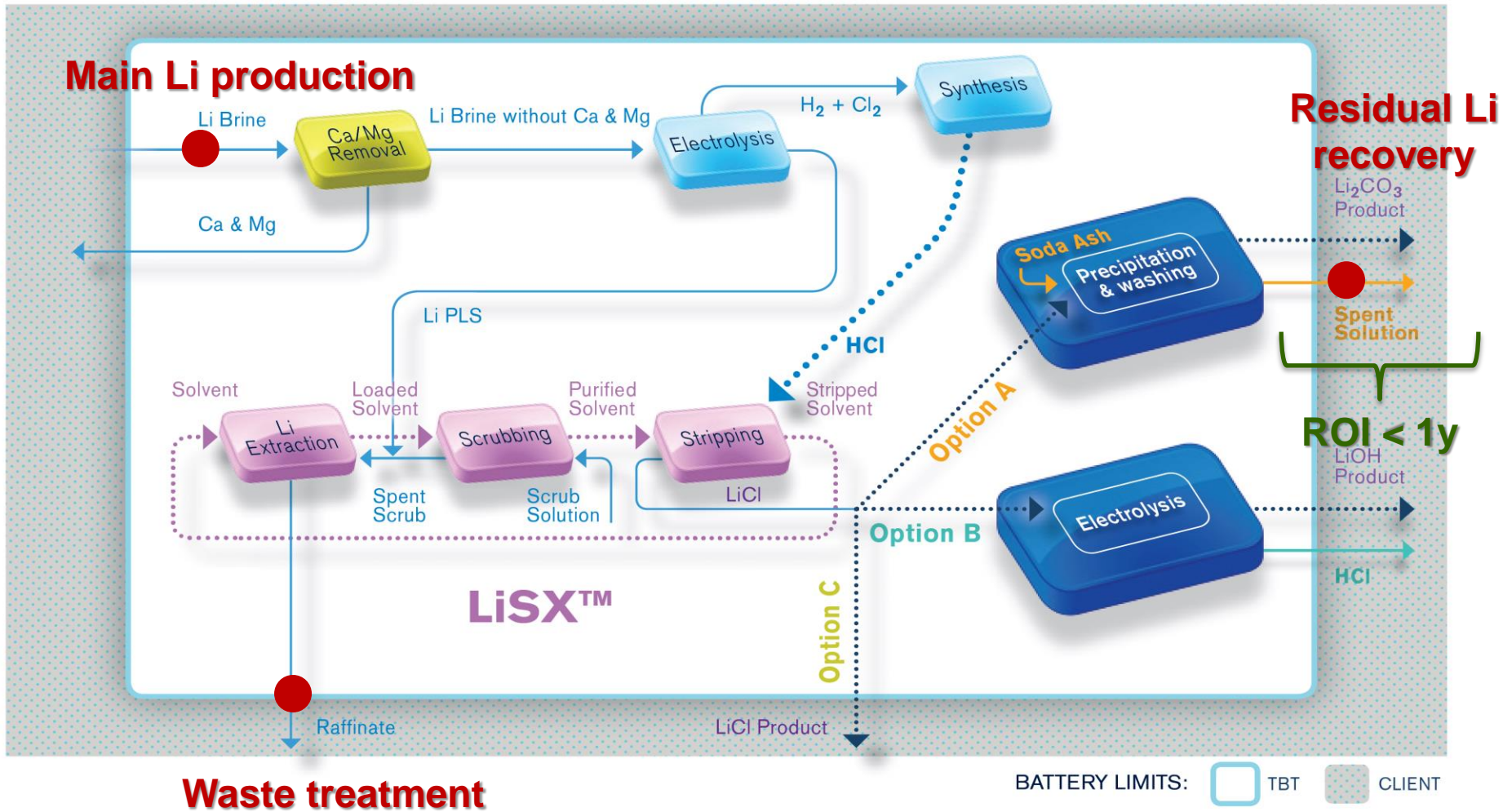
Alternative Product Routes



BATTERY LIMITS:  TBT  CLIENT



Where can LiSX™ Fit?





LiSX™ Advantages

General advantages

- Production of **saturated lithium** solutions in one step.
- Lithium production economics is **independent of by-products**.
- Lithium recovery > **99%**.
- Lithium purity > **99.9%**.
- **Lower CAPEX** and **OPEX**.
- **Lower factory footprint**.
- **Weather independent**.



LiSX™ Advantages cont.

Before the process

- Suitable even for dilute Li feed solution (<100 ppm).

Within the process

- Low energy consumption.
- Residence time from brine to product – hours.
- Can **simultaneously** produce **different** lithium **salts**.

After the process

- Residual lithium concentration below **1 ppm**.
- All spent solutions **suitable for reinjection** - no environmental impact.



Typical Product Composition

LiCl Produced In Laboratory Testwork

Element	[Li]	[Na]	[Ca]	[K]	[B]	[Mg]	[SO ₄]	[Cl]	pH
Units	g/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	g/L	
	68	**BD	BD	BD	BD	BD	BD	355	5

**BD – below detection (<3ppm)

Expected Product concentration

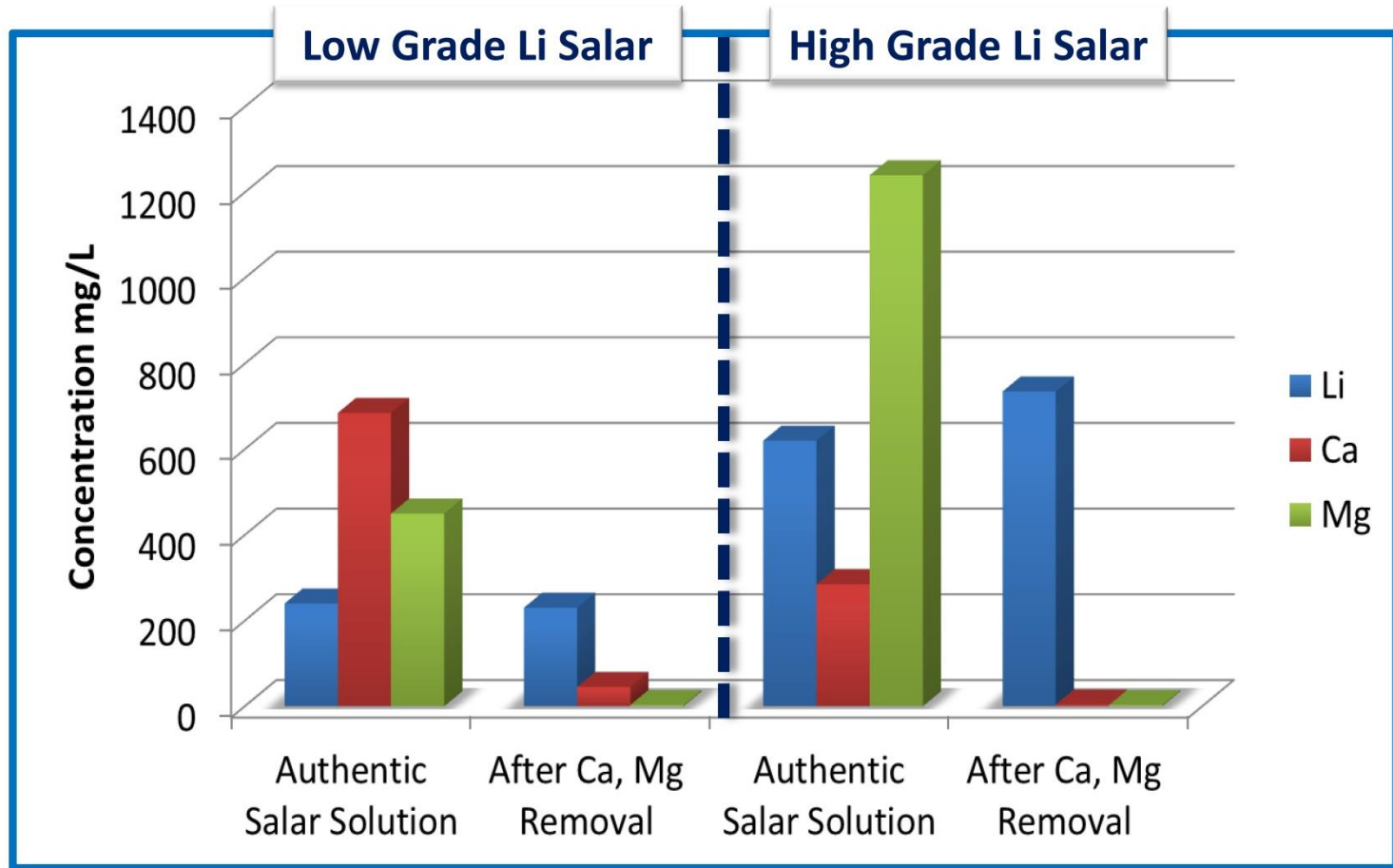
Salt	Concentration	[Li] g/L
LiCl	41%	85-90
Li ₂ SO ₄	26%	40-45
LiBr	50%	60-65
LiNO ₃	64%	90-95



Typical Capex & Opex: 20,000tpa Li_2CO_3 Plant

Feature	TBT Lithium Recovery Process	Traditional
Total Solution CAPEX	\$160M ~\$220M	\$250M~\$350M
Total Solution OPEX	\$1.8-2.5/Kg Li_2CO_3	\$2-3/Kg Li_2CO_3
Processing Time (from wells to end project)	Hours	18 Months
Recovery	Nearly 100%	Between 30% - 60%

LiP™ - Ca, Mg Removal

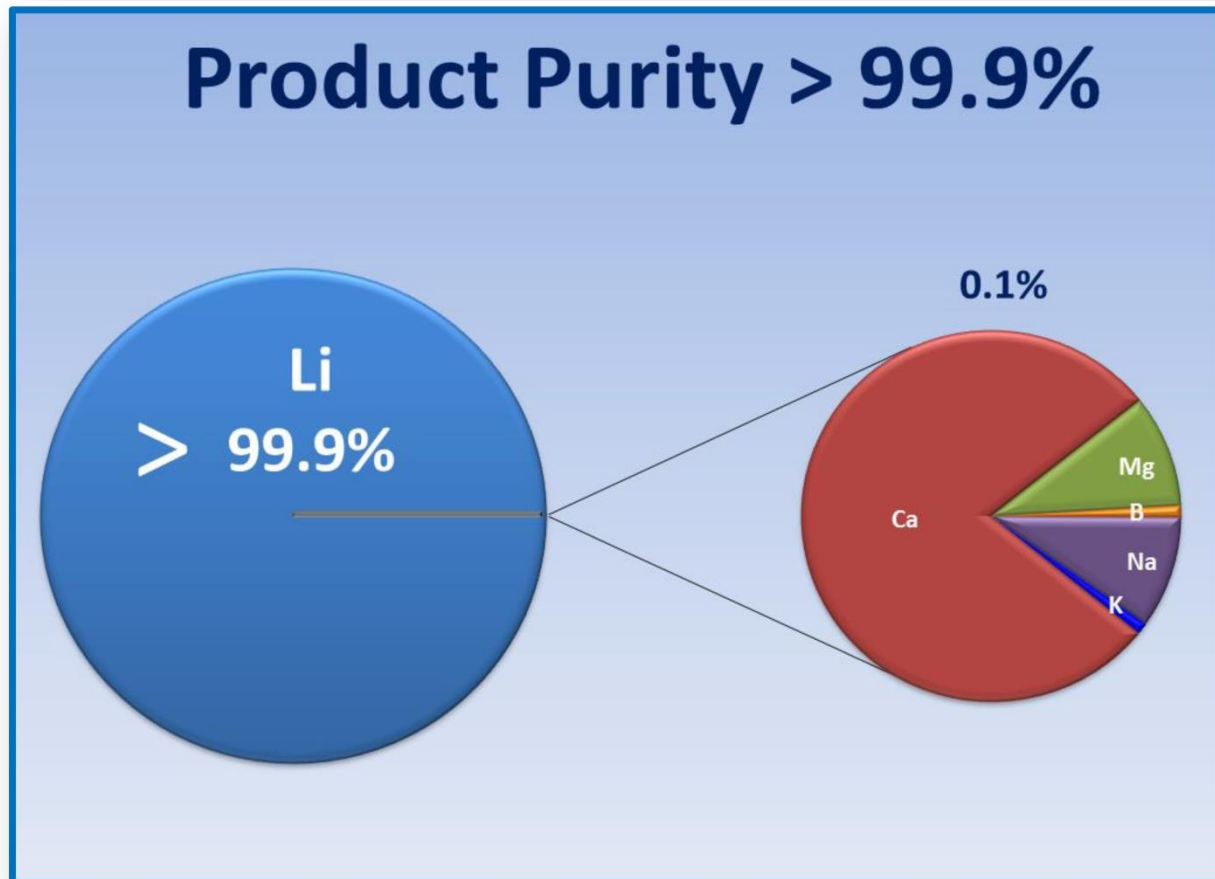


● Ca & Mg practically eliminated

● Lithium concentration remains constant



- Product quality is independent of the feed composition
- Raffinate (spent solution) stream has the same composition as the feed - excluding lithium



Thank you

