



TECNICAS REUNIDAS

PROPRIETARY TECHNOLOGY DEVELOPMENT DIVISION



Phos4life
ECOFRIENDLY RECOVERY



recyclion

ASAMBLEA GENERAL SUSCHEM

TÉCNICAS REUNIDAS

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Proprietary Technology Development Division

JOSE LLADÓ TECHNOLOGY CENTRE



Phos4life
COMPLETENESS SECURITY



Since 1971 **Proprietary Technology Development División (PTDD)** has supplied high-quality customer focused solutions **for non-ferrous metals** industries worldwide.

Its technical know-how and broad expertise in **hydrometallurgy and electrochemistry** fields is at the **industry service** succeeding in any Project **from laboratory stage to industrial implementation.**

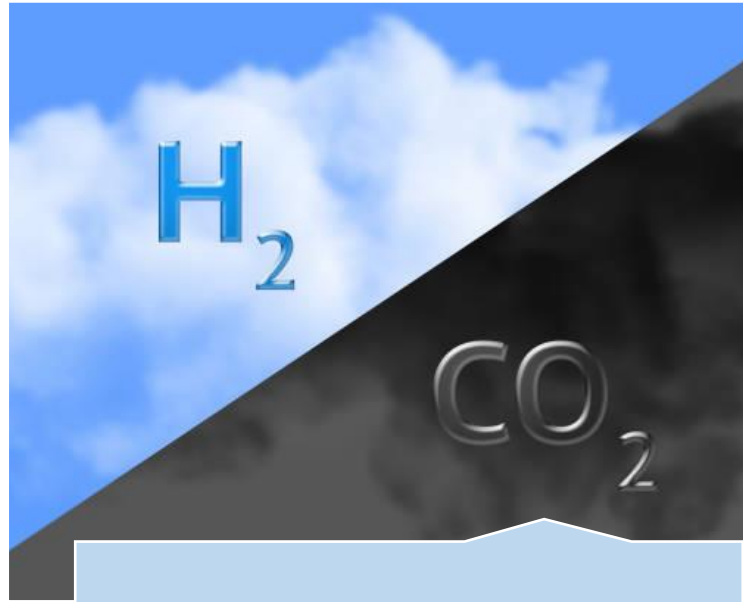
PTDD is one of the global leaders in processing with **Solvent Extraction Techniques** and a major player among **metal-recovery process** suppliers

In recent years, Técnicas Reunidas has decidedly focused on the **Energy Transition as a key** of its technological development

R&D AND BUSINESS AREAS



**Metals & CRM
CIRCULAR ECONOMY**



ENERGY TRANSITION



BIOREFINERY

METALS & CRM. CIRCULAR ECONOMY PORFOLIO



Metals & CRM
CIRCULAR ECONOMY

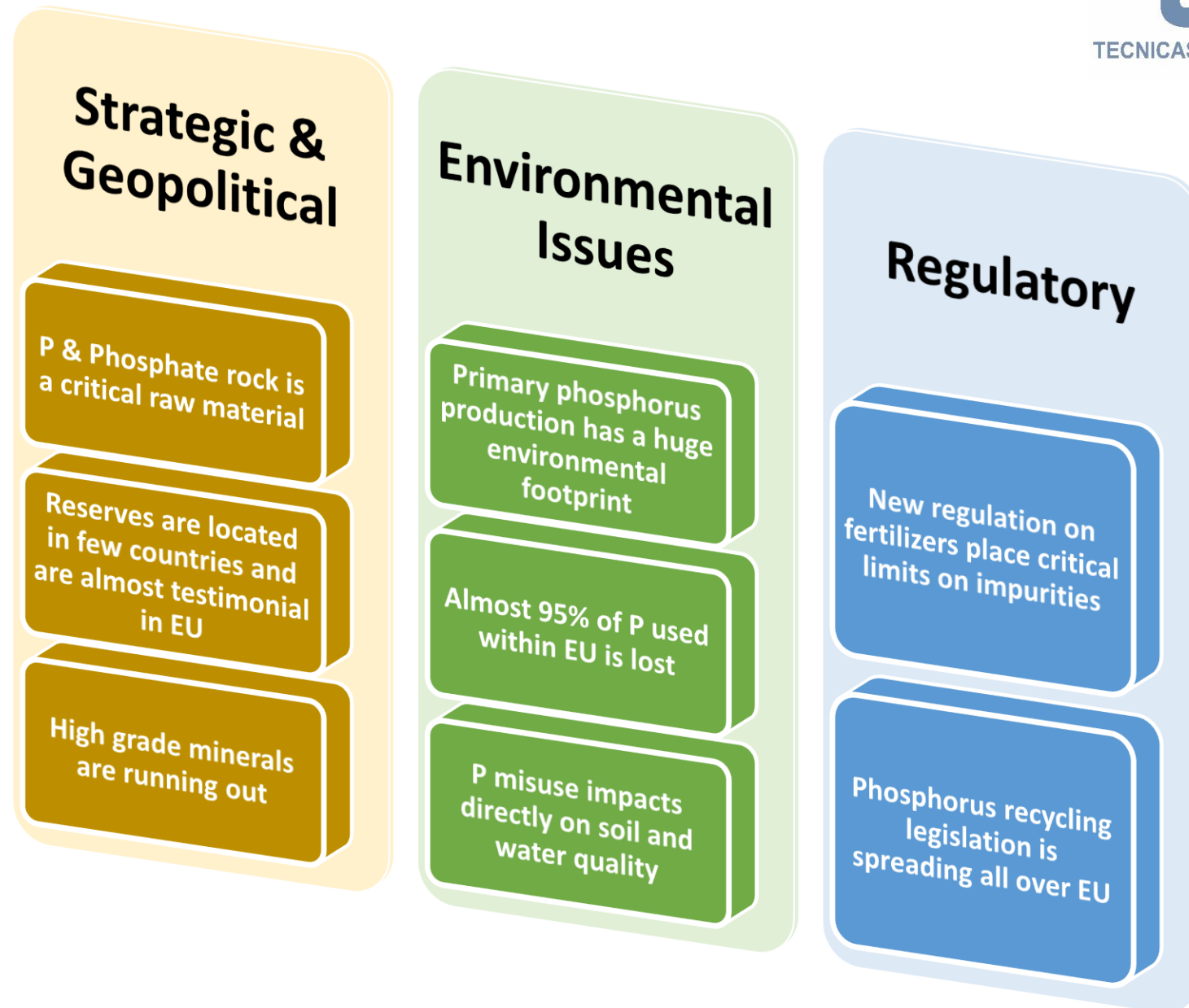
METALS / CRM	ENERGY TRANSITION SECTOR					TR TECNOLOGY	TRL	IP
	Solar	Electric Vehicle	Wind	Battery Storage	Hydrogen			
Zn	Green	Green	Green	White	Green	ZINCEX SOLVENT EXTRACTION	Commercial TRL 10	Patented
Ag	Green	Green	Green	White	White	ECO LEAD	Commercial TRL 10	Patented
Pb	Green	Green	White	Green	White	4 Phos4life ECOFRIENDLY RECOVERY	Flagship TRL 8/9	Patented
P	White	Green	Green	Green	White	RARE TECH TR	Demo TRL7	Patent pending
REE	White	Green	Green	White	White	REEs recovery at precursor grade, from tailings, permanente magnets and others industrial residues	lab/pilot TRL 3-5	Ongoing
Li	White	Green	White	Green	White	Li, Ni, Co recovery at battery grade from black mass and other industrial residues	Lab/pilot TRL 3 – 5	Ongoing
Ni	Green	Green	Green	Green	Green			
Co	White	Green	White	Green	Green			

TR technology core: SX

PHOS4LIFE



Phos4Life Technology



PHOS4LIFE – MAIN FIGURES

PHOS4LIFE TECHNOLOGY OFFERS A PHOSPHORUS RECOVERY PATH FROM SEWAGE SLUDGE ASH IN THE FORM OF TECHNICAL GRADE PHOSPHORIC ACID, A HIGH-PERFORMANCE CHEMICAL REAGENT.

PHOS4LIFE IS A PROPRIETARY TECHNOLOGY BASED ON SOLVENT EXTRACTION TECHNIQUES AND IT HAS BEEN DEVELOPED TO MEET REGULATIONS ON PHOSPHOROUS RECOVERY FROM SEWAGE SLUDGE.

PHOSPHOROUS RECOVERY IS ABOVE 85%.

P4L IS A FLEXIBLE TECHNOLOGY → DEPEND ON LOCAL CONDITIONS AND PROJECT GOALS (PRODUCTS & RESIDUE REQUIREMENTS) PROCESS IS ADAPTED

Feedstock

Sewage sludge ashes
from mono-incineration
plants

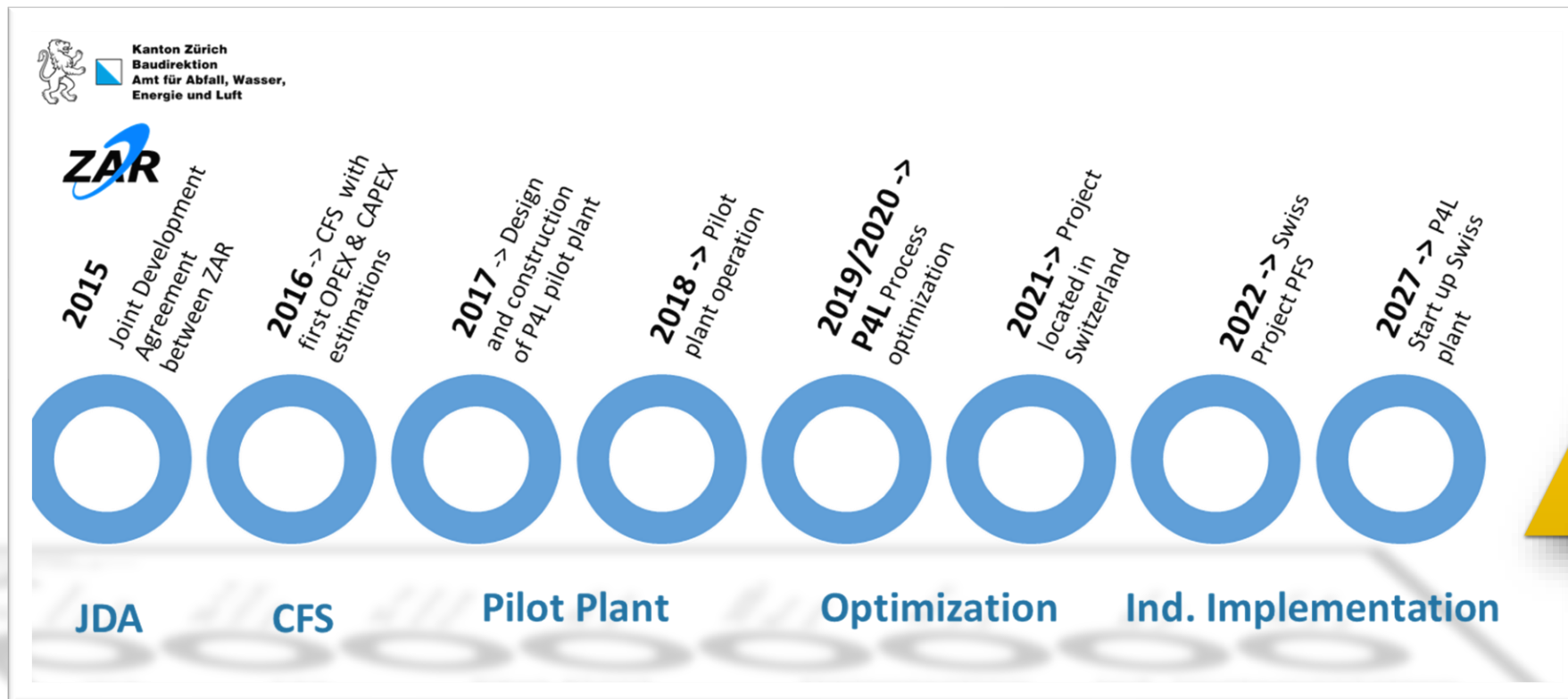
Products

Technical grade
phosphoric acid

Status

Technology development
and scale-up. TRL 8/9

PHOS4LIFE – TECHNOLOGY DEVELOPMENT STAGES



- SELECTIVE & NO PRODUCT DEGRADATION
- EASY REACTIONS CLOSE TO ROOM TEMPERATURE
- SIMPLE & NO COMPLEX EQUIPMENT
- FLEXIBILITY, RELIABILITY & ROBUSTNESS
- FULLY AUTOMATION ACHIEVABLE

Core Technology: SX



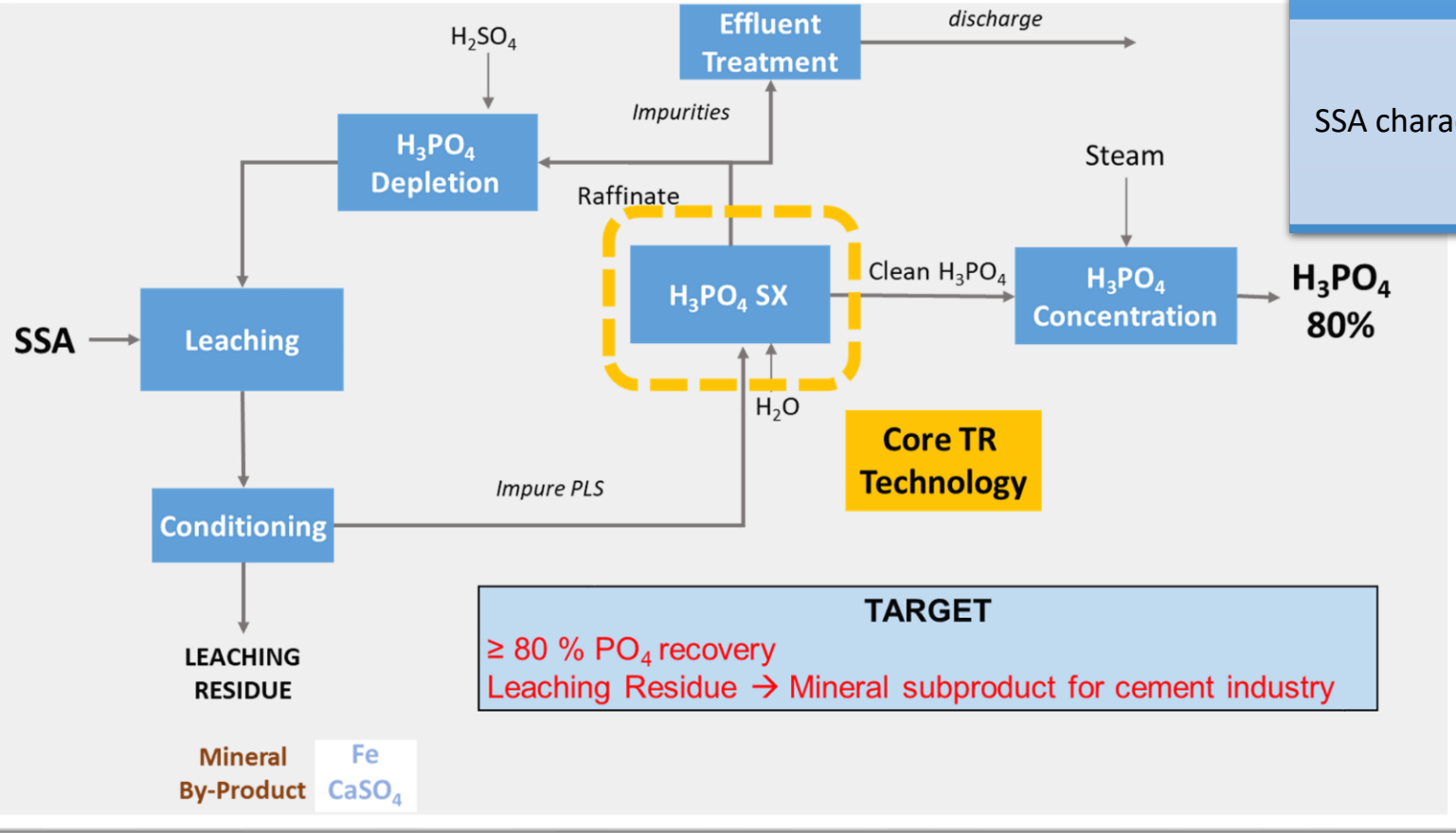
PHOS4LIFE – PROCESS DESCRIPTION

LOCAL CONDITIONS AND PROJECT GOALS HAVE A MAJOR INFLUENCE ON TECHNOLOGY ECONOMICS:

SSA characterization

Target raw materials and products

Potential synergies and industrial symbiosis must be taken into account



TARGET
 ≥ 80 % PO₄ recovery
 Leaching Residue → Mineral subproduct for cement industry



PHOS4LIFE – BUSINESS MODEL

TR's business model is based on **licensing Phos4Life technology** and providing all the necessary **engineering services** for its industrial implementation:

- Engineering, procurement and construction
- Technology Package
- Process and performance guarantee



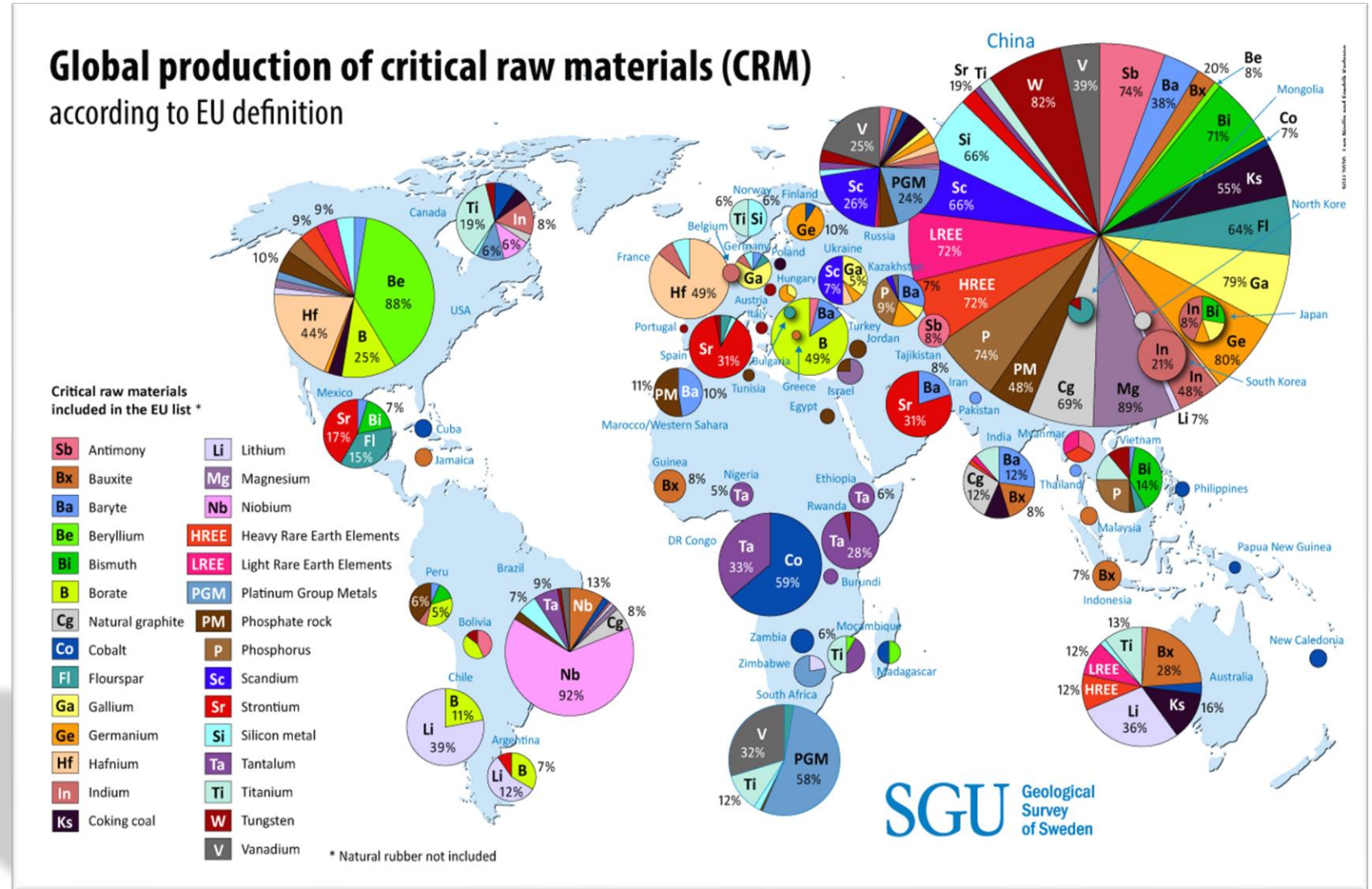


Global production of critical raw materials (CRM) according to EU definition

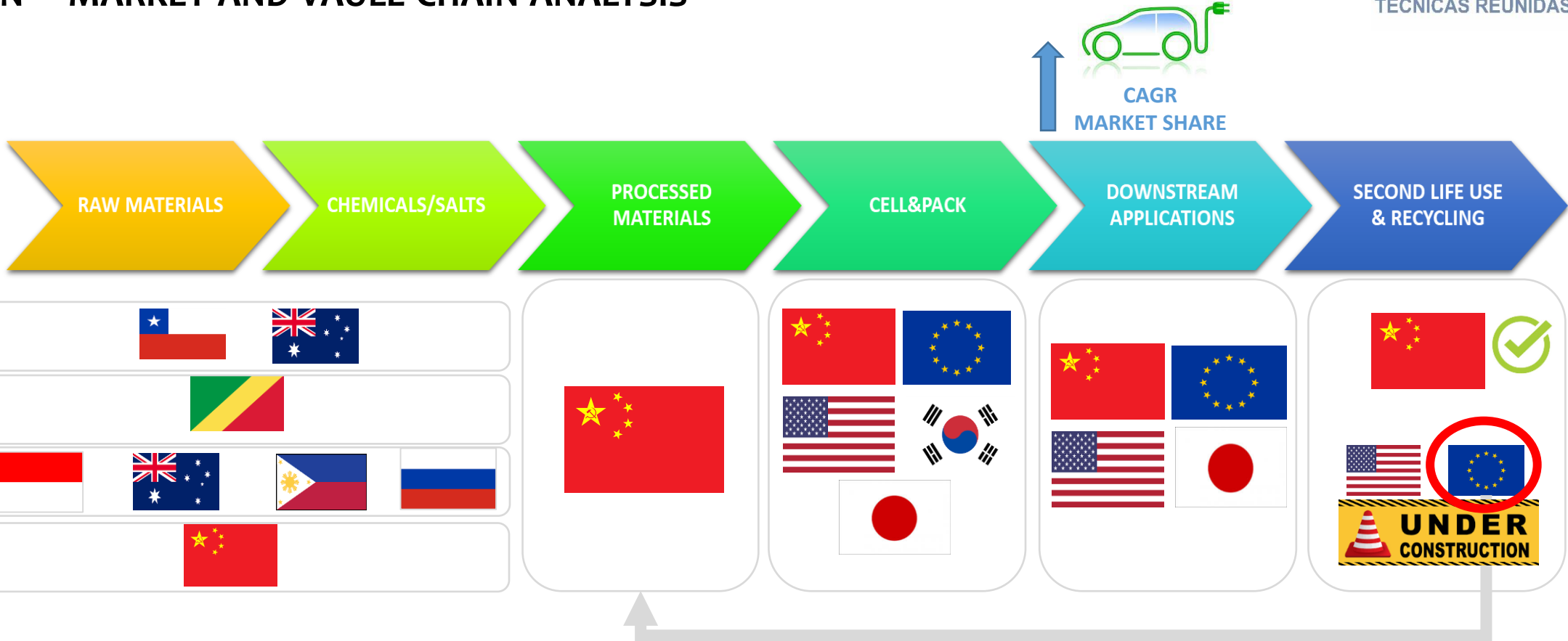
Critical raw materials included in the EU list *

- | | |
|----------------------------|---------------------------------------|
| Sb Antimony | Li Lithium |
| Bx Bauxite | Mg Magnesium |
| Ba Baryte | Nb Niobium |
| Be Beryllium | HREE Heavy Rare Earth Elements |
| Bi Bismuth | LREE Light Rare Earth Elements |
| B Borate | PGM Platinum Group Metals |
| Cg Natural graphite | PM Phosphate rock |
| Co Cobalt | P Phosphorus |
| Fl Flourspar | Sc Scandium |
| Ga Gallium | Sr Strontium |
| Ge Germanium | Si Silicon metal |
| Hf Hafnium | Ta Tantalum |
| In Indium | Ti Titanium |
| Ks Coking coal | W Tungsten |
| | V Vanadium |

* Natural rubber not included

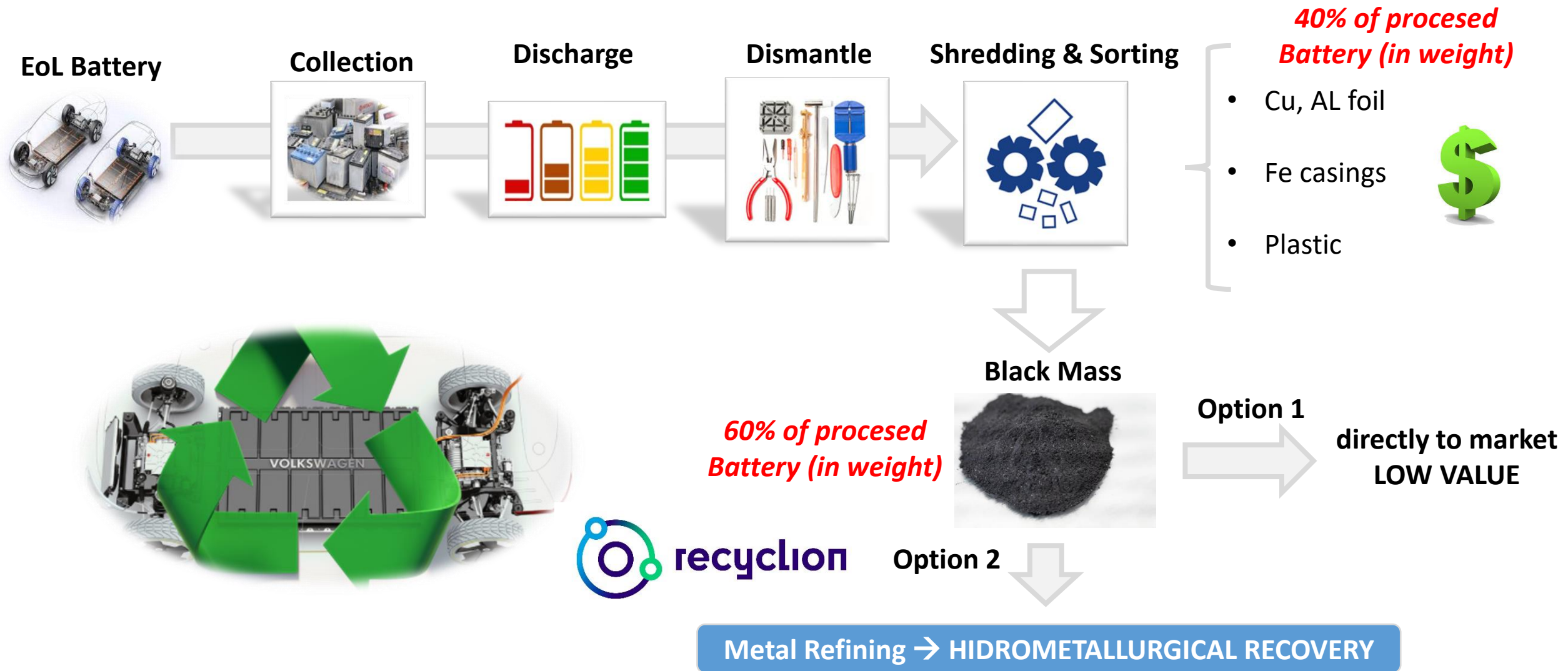


RECYCLION – MARKET AND VALUE CHAIN ANALYSIS



- ❑ EU SUPPLY CHAIN TO CONTROL RAW MATERIAL STOCK & PRICES
- ❑ ESTABLISH AS LEADER IN EV MARKET

RECYCLION – TECHNOLOGY DESCRIPTION AND GOALS



RECYCLION – TECHNOLOGY DESCRIPTION AND GOALS

Black Mass



60% of procesed Battery (in weight)






Option 2



Metal Refining →
HIDROMETALLURGICAL RECOVERY

43% of black mass is metals
57% of black mass is graphite (in weight)



- Lithium Carbonate or  Lithium Carbonate
- Lithium Hydroxide grade battery  Lithium Carbonate
- Nickel Sulphate grade battery  Nickel Sulphate
- Cobalt Sulphate  Cobalt Sulphate
- Manganese sulphate  Manganese Carbonate
- Recycled graphite

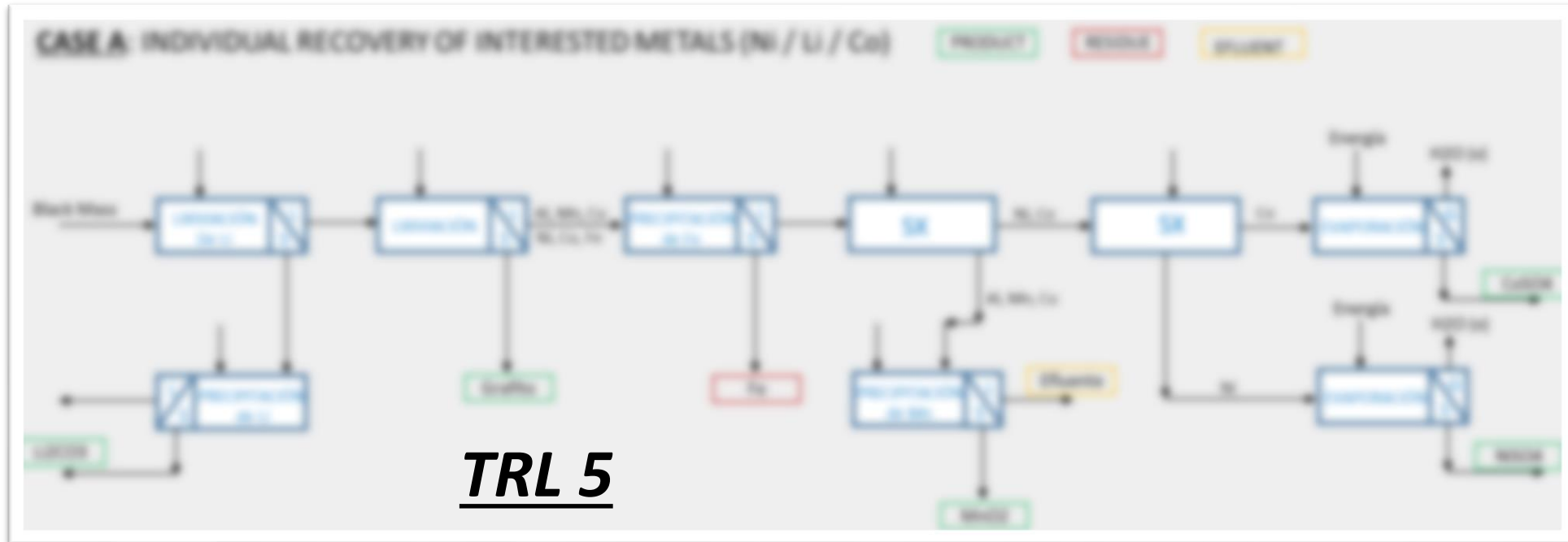


**Chemical Salts
HIGH MARKET
VALUE**

processed materials

CATHODE ACTIVE MATERIAL (CAM)

RECYCLION – CURRENT SITUATION AND NEXT STEPS



Validation Recyclion process at Pilot Scale

CAM prototype production at lab scale

CAM validation in a Li-ION cell



TECNICAS REUNIDAS

THANK YOU!!

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