Lithium recovery and battery-grade materials production from European resources: *from lab to pilot*

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CLUSTER HUB
PRODUCTION OF RAW MATERIALS FOR BATTERIES FROM EUROPEAN RESOURCES

PRODUCTION OF RAW MATERIALS FOR BATTERIES FROM EUROPEAN RESOURCES

2025 Annual workshop

Thursday, 20 November 2025 | Brussels

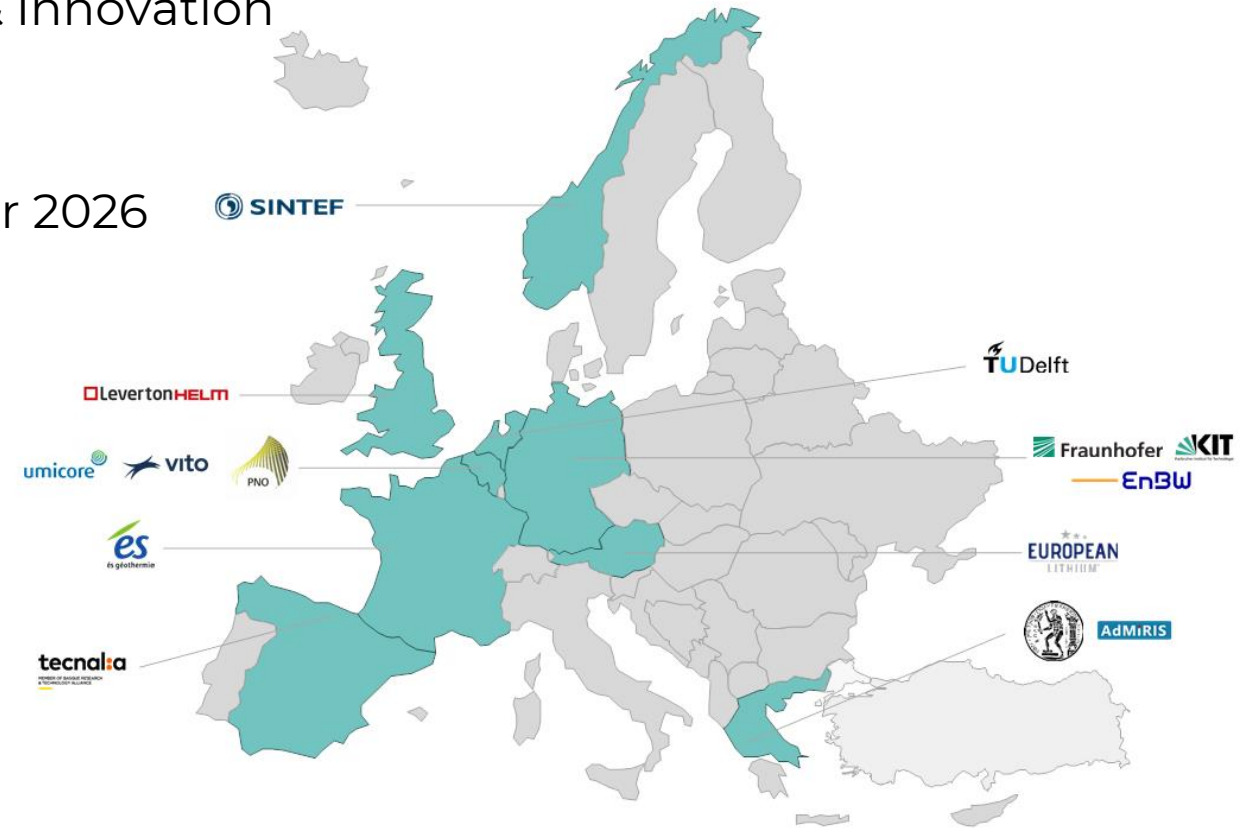
Introduction: *general information*

Coordinator: Fundación Tecnalia Research & Innovation

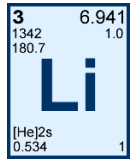
Participants: 16 partners from 10 countries:

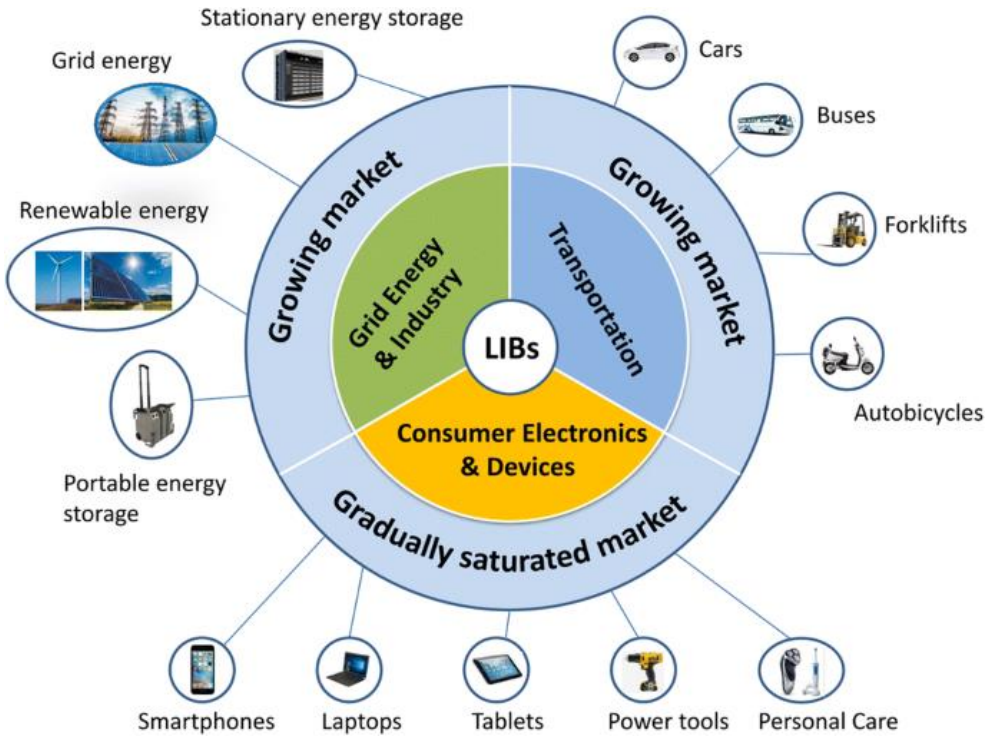
Duration: 1 October 2022 to 30 September 2026

Project budget: 6.8 M€



Introduction: *motivation*





Source: Study on the EU's list of Critical Raw Materials (2020), Final Report (URL)

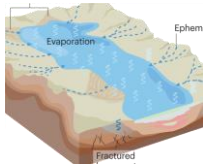
- **Li** is a valuable metal with important applications in the following sectors:
  - *Grid Energy & Industry*
  - *Consumer Electronics & Devices*
  - *Transportation*.
- **Li** is playing a key role in the transition to a fossil fuel-free economy, aiming to reduce the house-hold gases and global warming.
- In the EU, there is a growing concern to find novel sustainable and environmentally-friendly routes for lithium production.

Introduction: *objective*

The LiCORNE project aims to establish the **first ever Li supply chain in Europe**, increasing the European Li processing and refining capacity for producing battery-grade chemicals from:

- **Ores and tailings**

- **Continental brines** and **Geothermal brines**



- **Off-specification cathode materials**

Source	Li conc.
Spodumene	≈3.1%
Lithic mica	≈1.7%
Lithium phosphate	≈0.2%
Continental brines	≈2000 mg/l
Geothermal brines	≈150 mg/l
Off-spec. cathode	≈6.5 %

Work plan

Year 1: M1 – M12	Year 2: M12 – M24	Year 3: M25 – M36	Year 4: M37 – M48
Research & Development			Upscaled process (to TRL5)

WP 1 - TEC: Project Management

WP 2 - ESG	WP 3 - NTUA	WP 4 - KIT	WP 5 – VITO	WP 6 - SINTEF	WP 7 - LEV
Supply and characterization of feedstock	Beneficiation of ore and physico-chemical transformation	Extraction from concentrates, waste cathode material, ore and tailings	Separation and purification of solutions	Recovery as battery-grade chemicals	Operation and validation of LiCORNE process

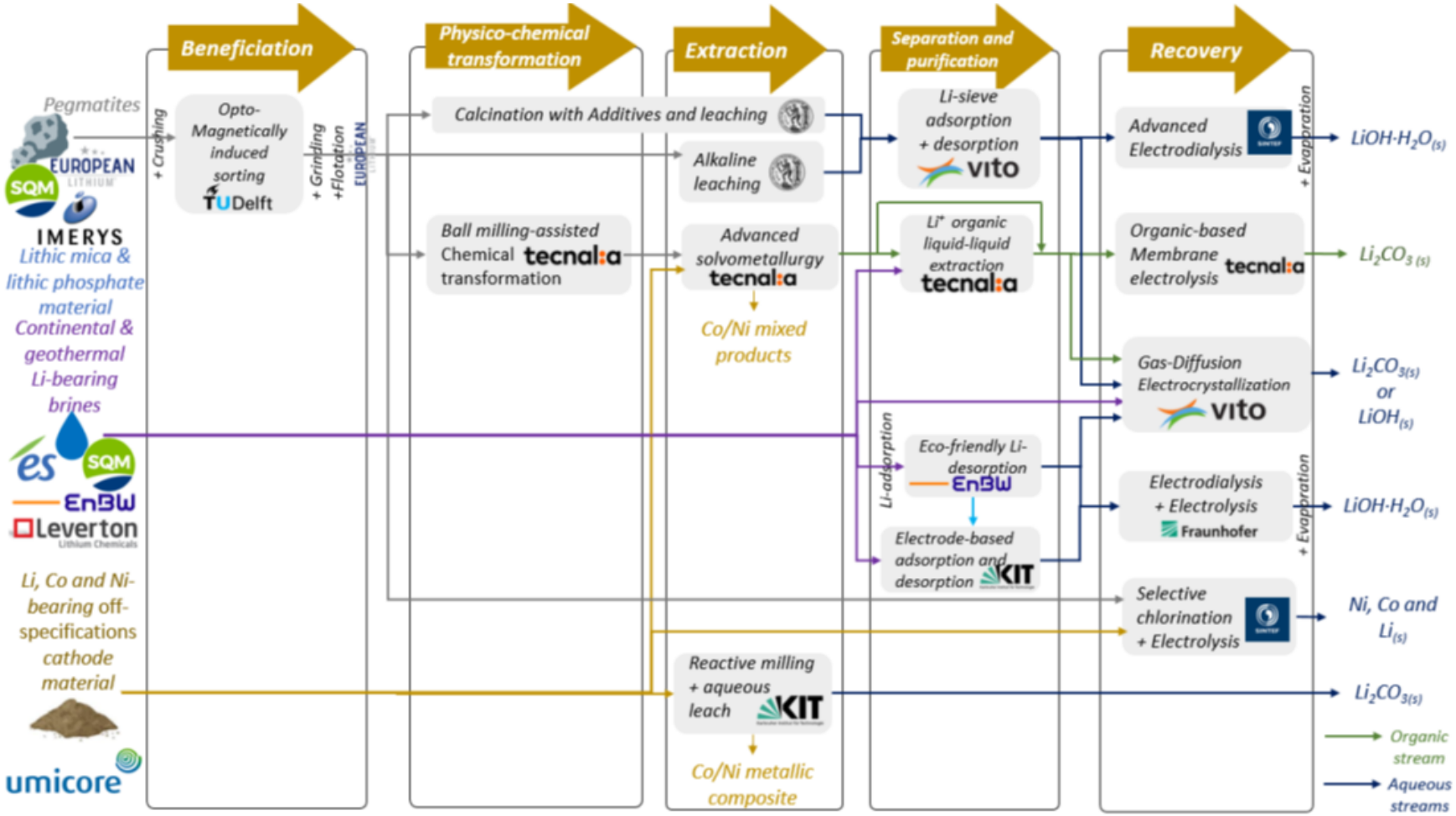
WP 8 - TEC: Environmental and economic sustainability assessment

WP9 - PNO: Development of Communication, Dissemination and Exploitation (CDE) actions

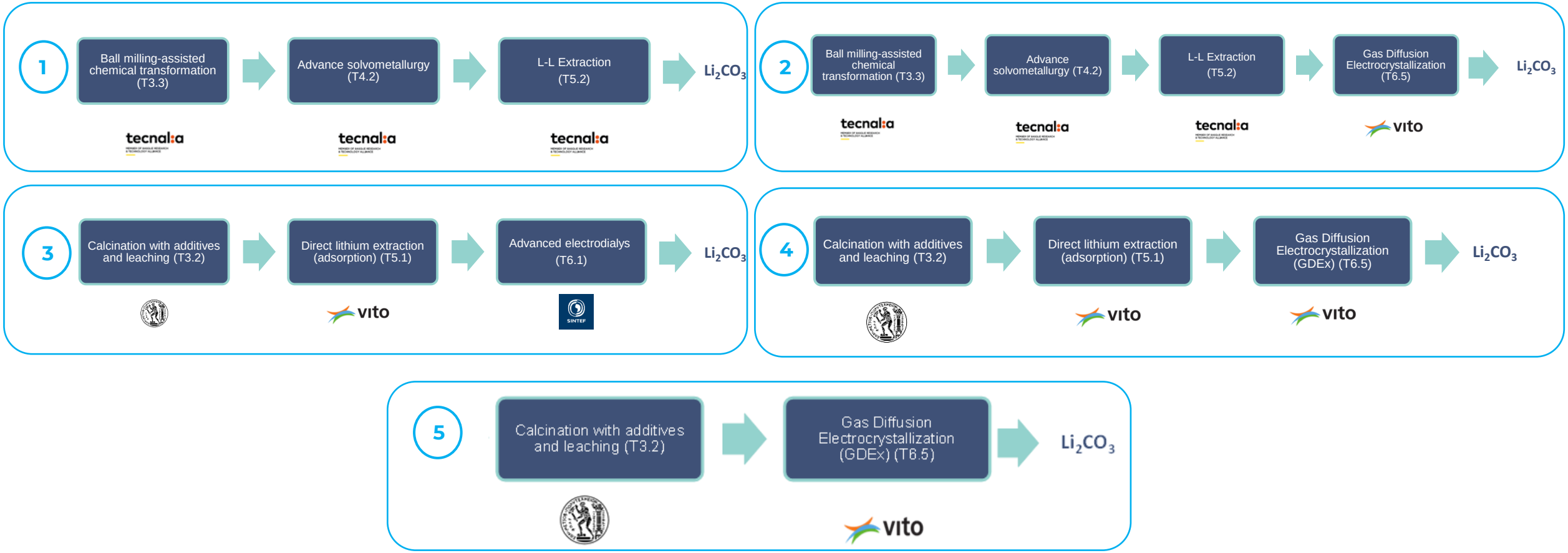
Lab scale: *the objective* → To **develop technologies at TRL 4**

- **Beneficiation** technologies to increase Li concentration in pegmatites
- **Physico-chemical transformation** of Li-pegmatite concentrates with non-acidic and lower temperature (~200°C) technologies to facilitate downstream processes
- **Efficient extraction of Li** contained in pegmatites concentrate and Li, **Co and Ni** from cathode waste, targeting 90-95% Li extraction while eliminating high-energy process such as calcination and sulfuric acid use.
- **Separation and purification** of Li from leachates and brines, targeting 94-99% Li selectivity
- **Recovery of Li** as battery-grade chemicals (Li_2CO_3 / $LiOH{\cdot}H_2O$ / Li metal) targeting minimum 99% purity

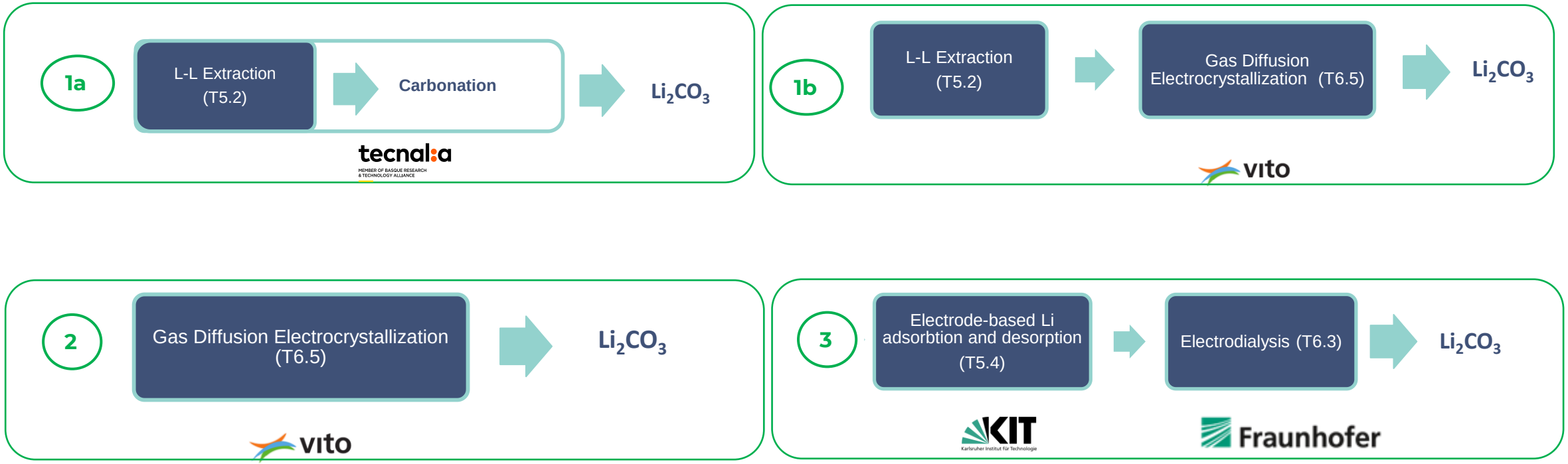
Lab scale: *the concept*



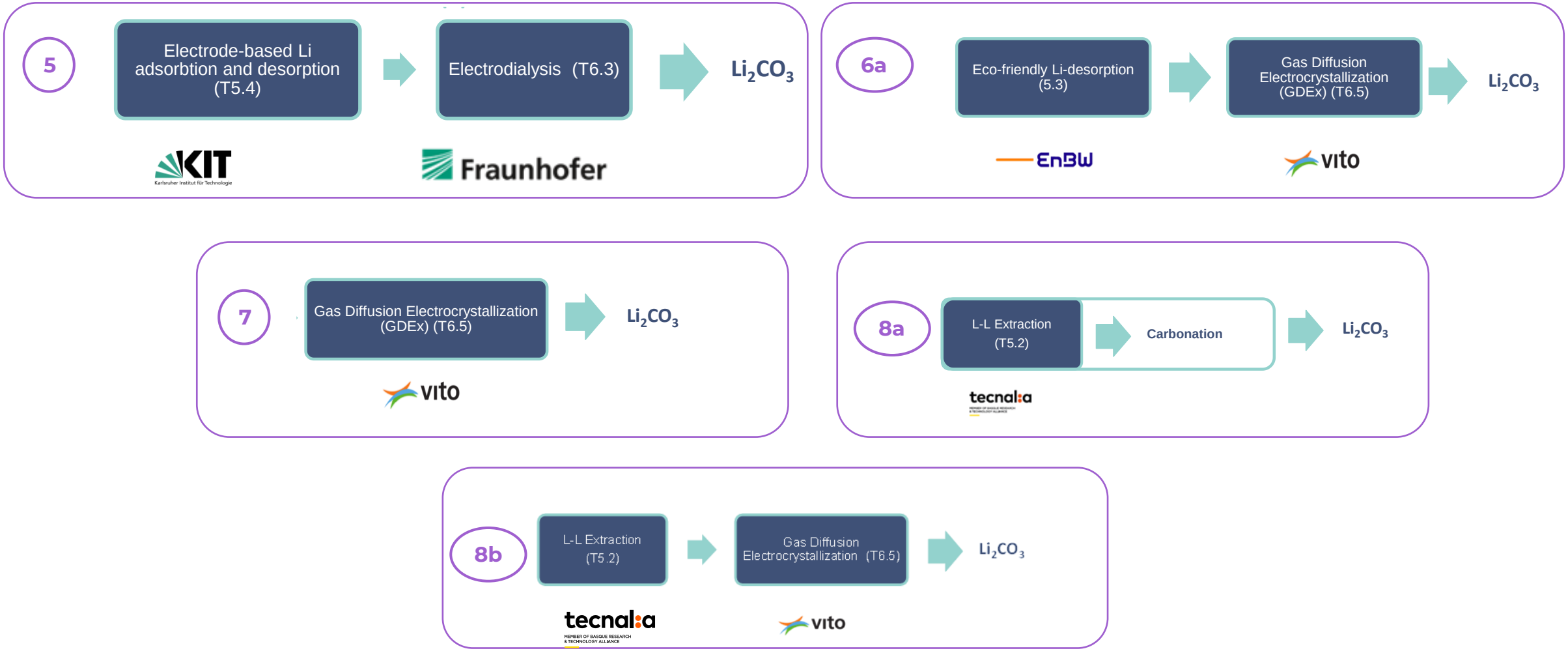
Lab scale: *the routes* - **Spodumene**



Lab scale: *the routes* - **Continental brines**



Lab scale: *the routes* - **Geothermal brines**



Lab scale: *the routes* - Off-specification cathode materials

1

Advance solvometallurgy (T4.2) → Membrane electrolisis(T6.2) → Li_2CO_3

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Advance solvometallurgy (T4.2) → Gas Diffusion Electrocrystallization (T6.5) → Li_2CO_3

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5

Reactive milling and aqueous leaching of waste cathode material (T4.3) → Li_2CO_3

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6

Chlorination + electrochemical recovery of metals (T6.4) → Li metal

SINTEF

Lab scale: *ranking of the routes*

- **LCA & LCC** assessment of the individual technologies (optimization)
- **Integration** of the results for each route

$$\textbf{Ranking value} = \frac{\textbf{Product adjust}}{\textbf{LCA} \times \textbf{LCC}}$$

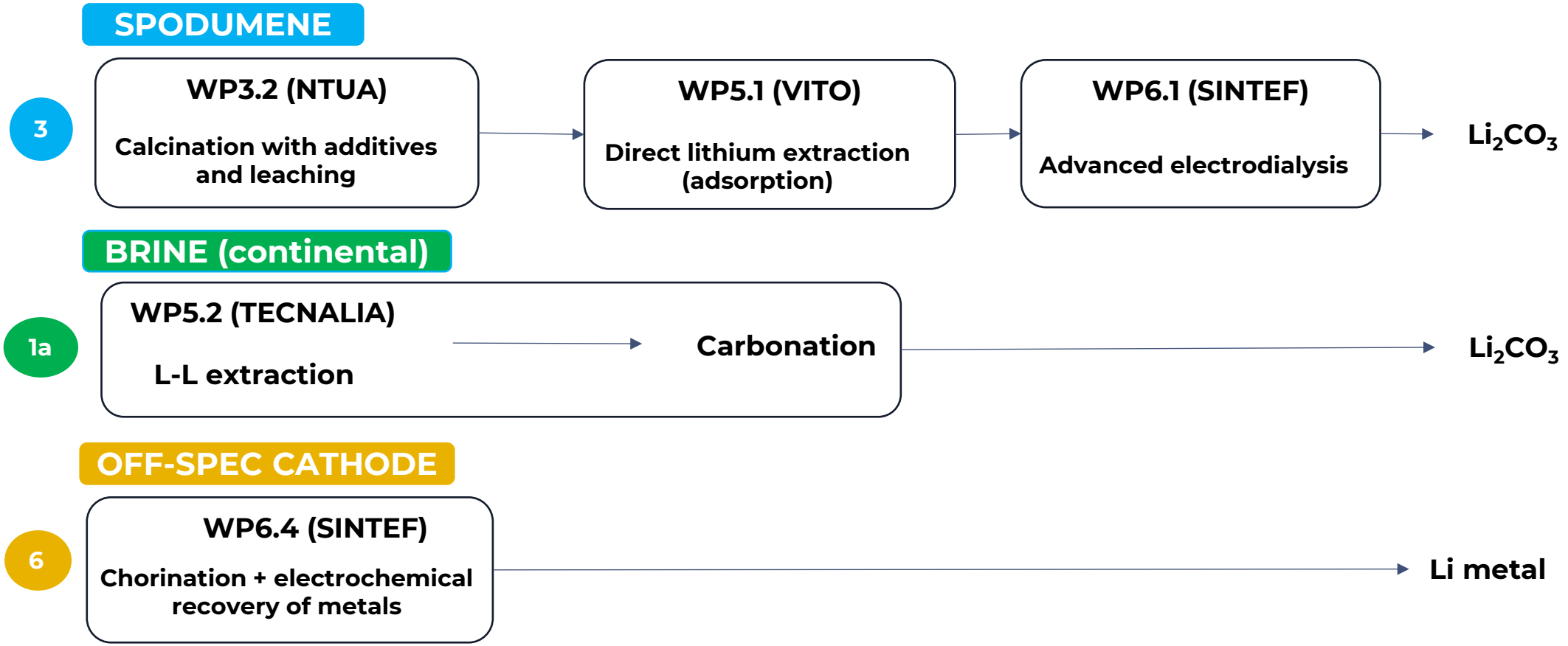
  - The "product adjust": calculated considering three aspects of the quality of the final product : purity in Li, impurities measured and unknown content.
  - The higher the Product adjust and the lower the LCA and LCC, the higher the Ranking value of the route, meaning that it is best positioned for the decision for the upscaling.

- **Ranking** of the flowsheets/routes technically feasible

All the ranking values obtained were normalized

Pilot scale: *the objective* → To upscale the most promising technologies to **TRL 5** and production of **~1 kg** of battery-grade Li chemical

The three **candidate** routes for the upscaling



Pilot scale: *the feasibility study*

The three candidate routes were evaluated and selected as the **final routes** for the upscaling considering the following key parameters:

- ✓ **Scalability** of the technologies in the flowsheets: ***all the technologies possible to upscale at TRL5***
- ✓ **Mass-transfer** scheme between partners involved in the processes: only in the spodumene route required from NTUA to VITO and from VITO to SINT. ***No problems are foreseen for the delivery of the solutions that will be produced.***
- ✓ **Equipment available** at R&D partners organizations: ***an important number of equipment available at the partners location.***
- ✓ **Quotations** of equipment and reagents purchases needs versus **budget** available in the project: ***feasible to proceed with the purchases according to both economy and delivery time.***

Thank you

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Consortium