Extractive waste reprocessing for metals and construction raw materials

NEMO & REEBAUX

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UN Sustainable Development Goals

From Problem to Opportunity

- Worldwide, there is a huge and ever growing amount of extractive waste.
- When poorly managed, these “tailings” can cause environmental **problems** such as acid mine drainage and can pose **risks**, e.g. tailings dam breakage.
- Yet, they can still contain **valuable** & critical metals and materials.

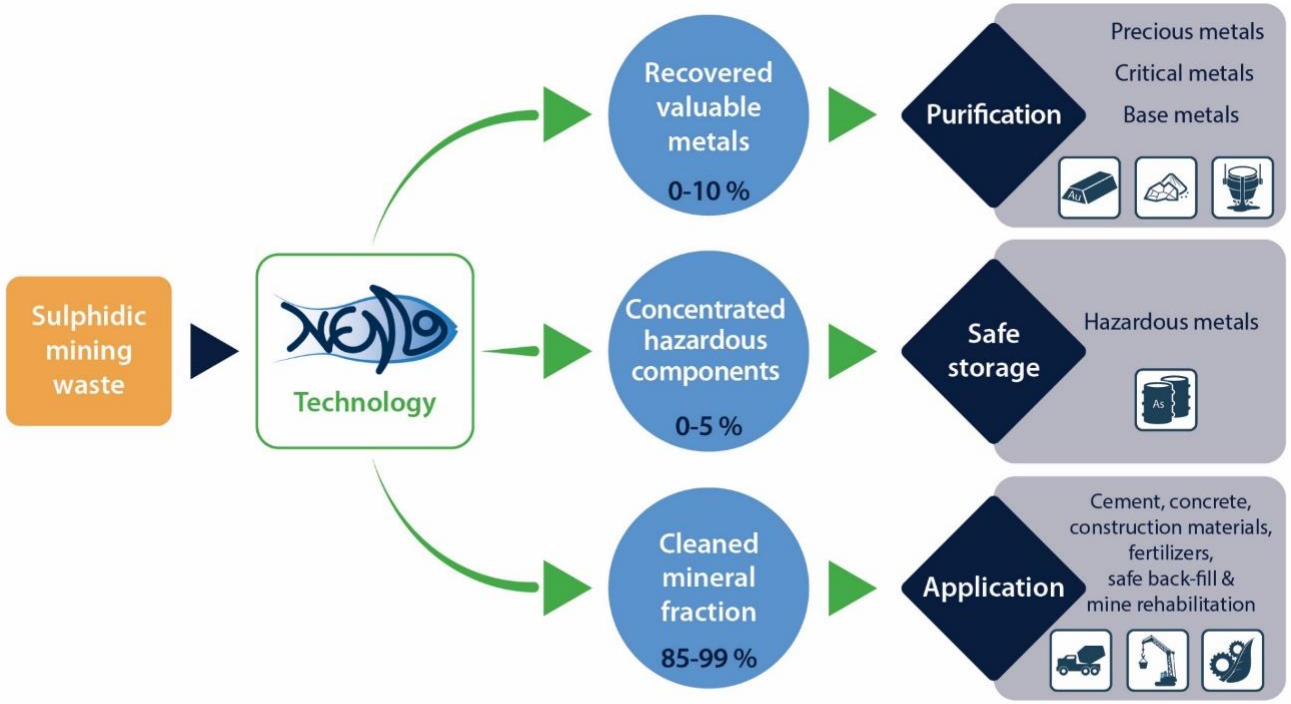
- **General evolution in the mining sector:**
  I. Recovery of a few g/t (e.g. gold mining)
  II. Recovery of associated metals
  III. Integral valorisation of the ore

Examples for innovative approaches: NEMO & REEBAUX

Near Zero Waste Recycling

NEMO - “Near-zero-waste recycling of low-grade sulphidic mining waste for critical-metal, mineral and construction raw-material production in a circular economy”

- **The NEMO Pilots are located at key points in the near-zero waste flowsheet, encompassing:**
  - Leaching and recovery of valuable & critical metals
  - Removal of sulphides and hazardous elements
  - Treatment of “cleaned” residual mineral fraction, either for use in cement, concrete and construction products, or for safe back-fill and post-closure mine rehabilitation
  - Hereby, NEMO aims to reduce the waste to only 5% of its original volume

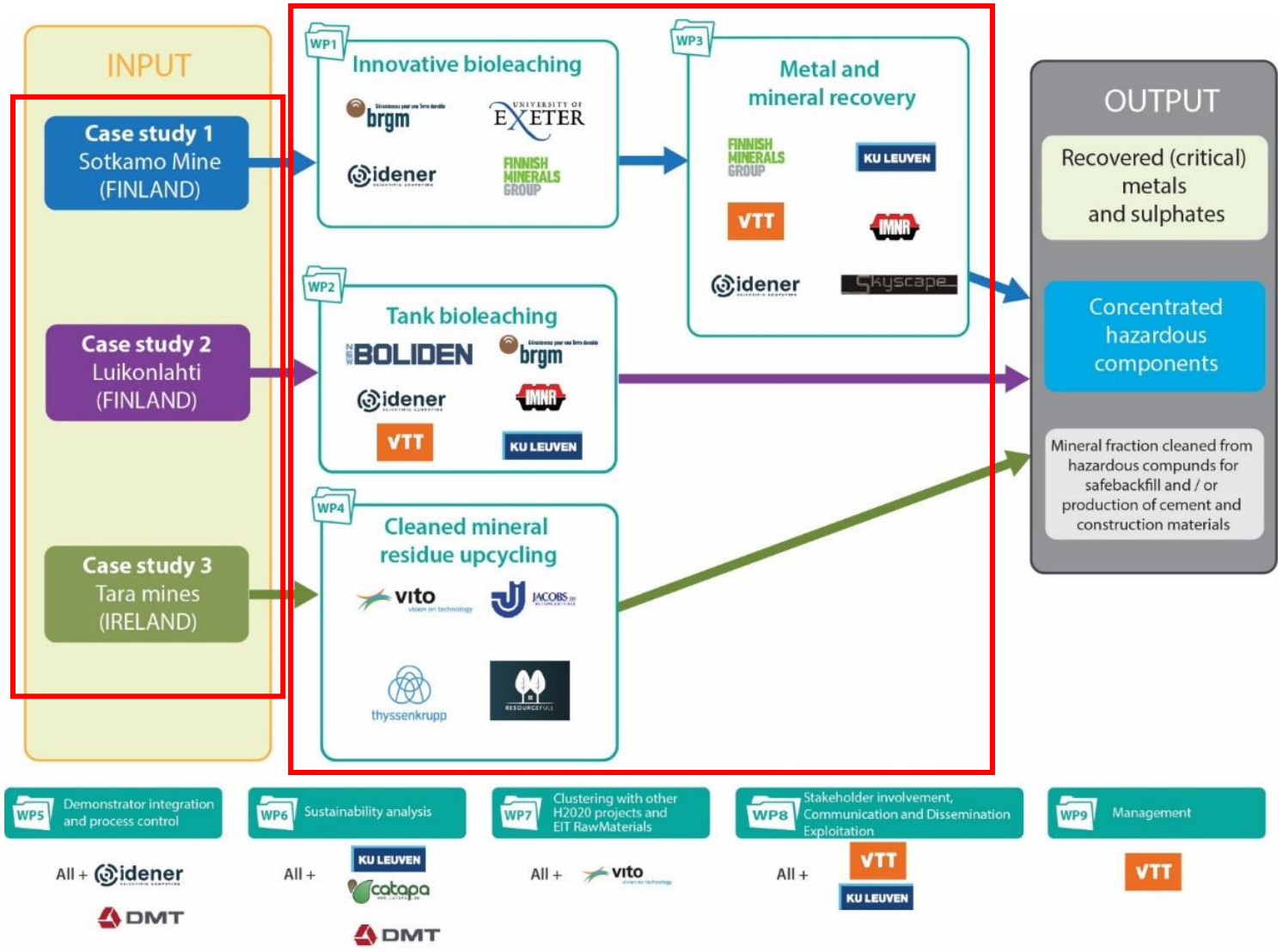


- Horizon 2020
- Total budget: 12 407 294 €
- Time frame: 2018 – 2022

Low-grade Sulphidic Mining Waste

- **NEMO: 3 case studies**
  - Sotkamo Ni-Co-Zn-Cu mine, Finland
  - Luikonlahti Cu-Zn-Ni-Co-Au processing plant, Finland
  - Tara mines (Zn-Pb-Ag), Ireland

- **4 technical work packages:**
  - bioleaching (in tanks, ponds, heaps) (WP1-2)
  - metal recovery from leach solution (sulphide and hydroxide precipitation) & metal purification (solvent extraction) (WP2-3)
  - mineral fraction valorisation in cement and construction materials (WP4)



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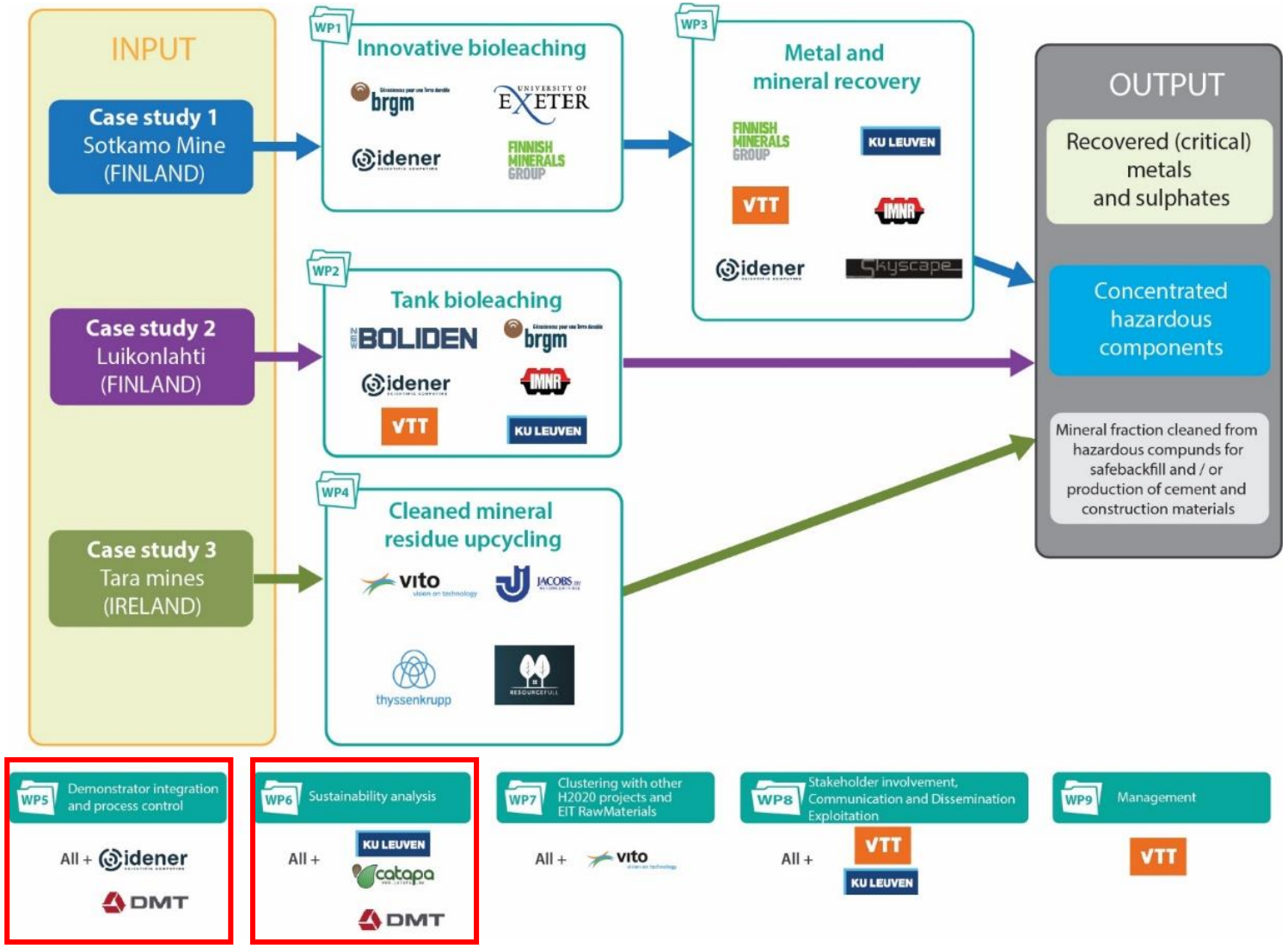
- **5 supporting work packages**
- **WP5** Demonstrator integration and process control
- **WP6** Sustainability Analysis
  - Economic assessment
  - Risk assessment

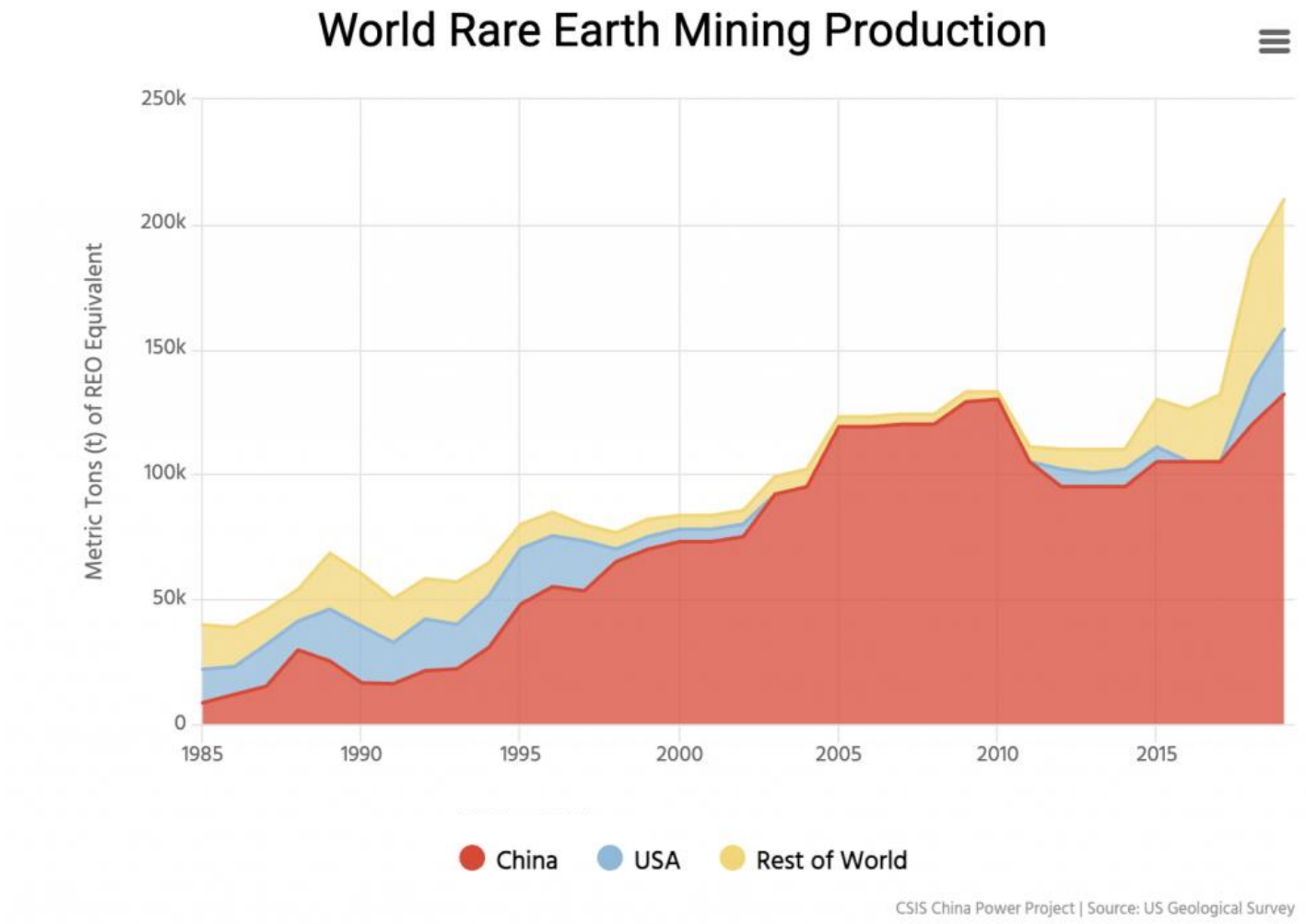


Bauxite and Red Mud

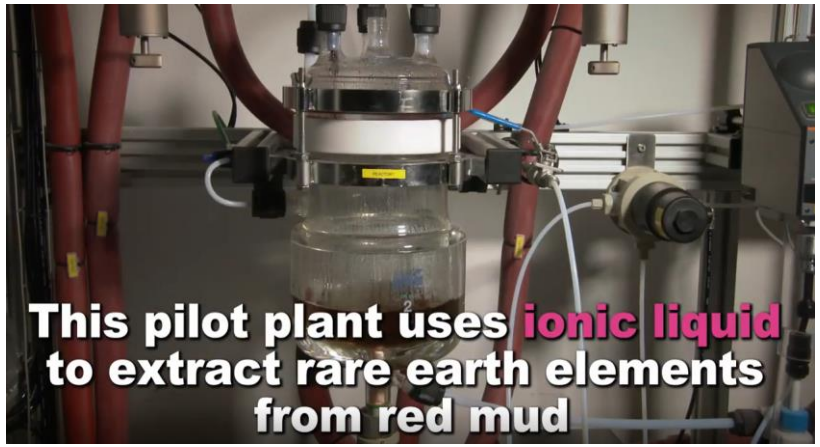
REEBAUX - "Prospects of REE recovery from bauxite and bauxite residue in the ESEE region"

- Market deficiency in Europe-sourced REE supply
- REE bauxite deposits & Red Mud accumulations still not utilized
- REE bauxite abundancies
- New extraction techniques

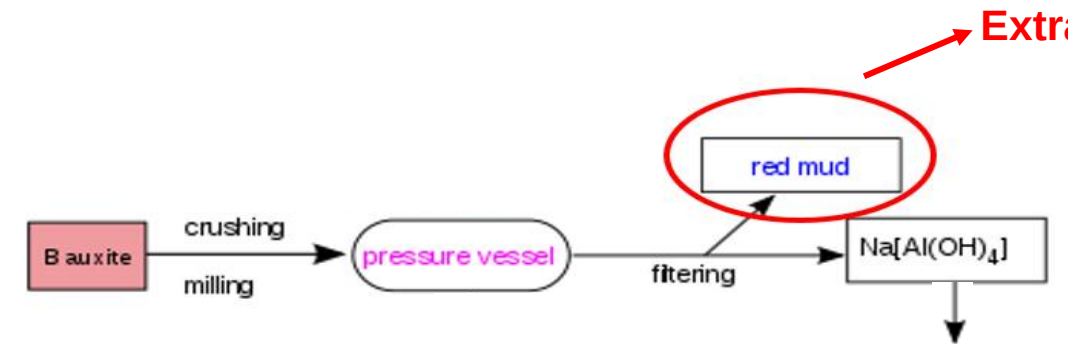
- EIT RawMaterials RIS
- Total budget: 244 700 €
- Time frame: 2018 – 2020



The Concentration of REE during the Bayer-Process



Source: Mytilineos



Bayer-process

Aluminium Production

Element	Karst Bauxite Greece	Lateritic BauxiteGhana	Bauxite ResidueGreece, AoG
	ICP-MS	INAA	ICP-MS
	(mg/kg)	(mg/kg)	(mg/kg)
La	57 ± 7	19.1 ± 1.3	130 ± 1
Ce	206 ± 8	34 ± 1	480 ± 26
Pr	15 ± 1	n/a	29 ± 2
Nd	53 ± 6	13 ± 1	107 ± 0

Red Mud can contain > 100 ppm Sc

Challenges for Extractive Waste Reprocessing

- Long and sometimes erratic permitting process
- Reaching economic feasibility
- Difficult to attract investors if foreseen profit is low
- Changing frame conditions
- Challenging to evaluate all different processing options / identifying BAT
- Lack of established resource statements like JORC, NI 43-101 etc. for secondary resources
- Classification as „waste“ can complicate the material handling and transport, different taxation
- If merely selected elements are extracted, the overall tonnage of the residual material keeps almost the same
- New processes have to be not only economically feasible, but also sustainable in terms of environment and social aspects

Conclusions

Despite many challenges, reprocessing of extractive waste can turn liabilities into assets

- Development of clean and environmentally sound technologies

- Save CO2 by avoiding primary mining (e.g. lower extraction and comminution efforts)

- Become more independent from raw material imports

- Reduction of extractive waste
- Sustainable management of natural resources
- Obtain social license to operate

- Reduction of land use
- Rehabilitation of environmental liabilities
- Reduction of water pollution

Thank you for your attention!

TÜV NORD GROUP