



**Recovery of Tungsten, Niobium and Tantalum occurring as by-products in mining and processing waste streams**

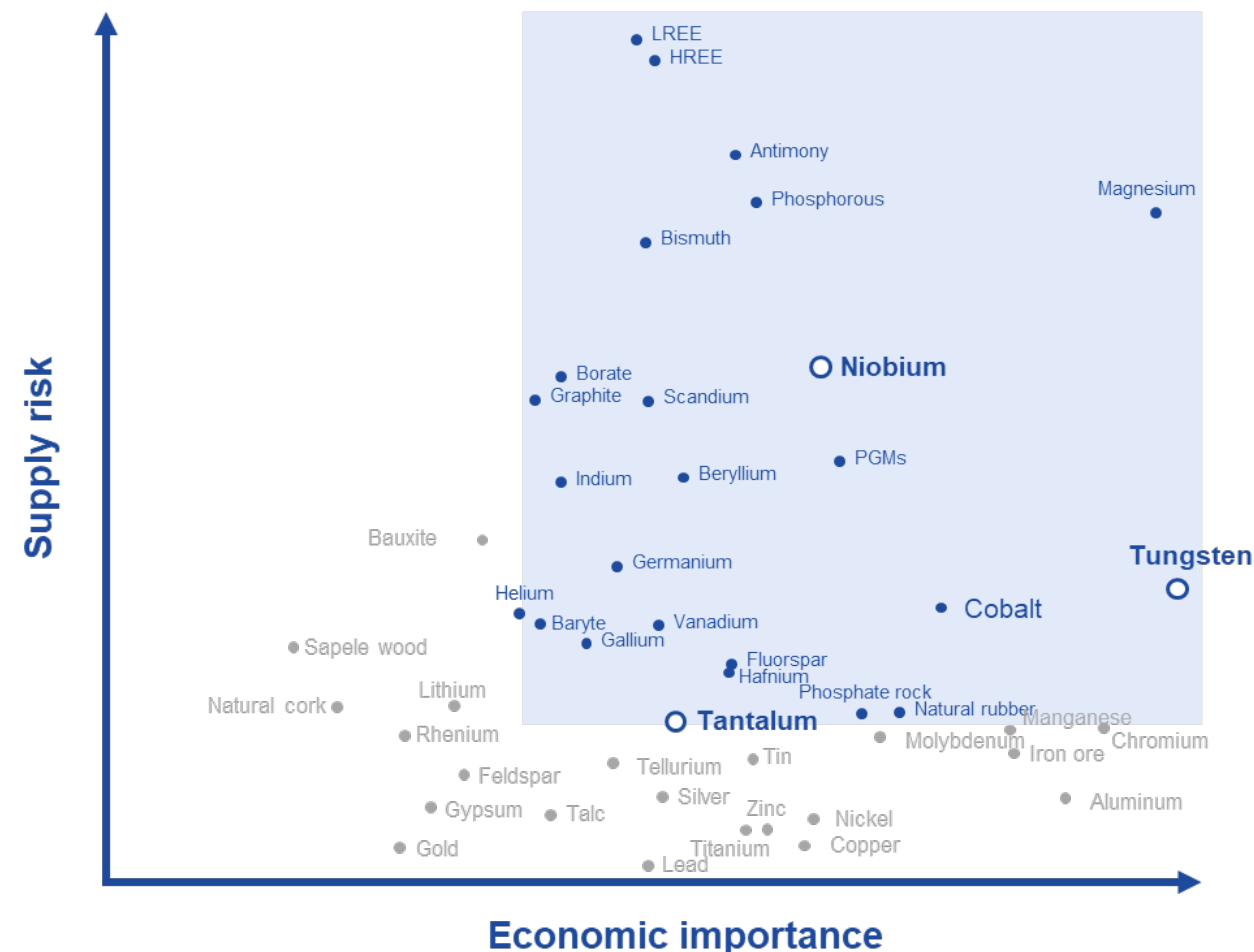
EU H2020 project “TARANTULA” - General presentation

The TARANTULA project has received funding from the European Union's EU Framework Programme for Research and Innovation Horizon 2020 under Grant Agreement No 821159 - <https://h2020-tarantula.eu/>

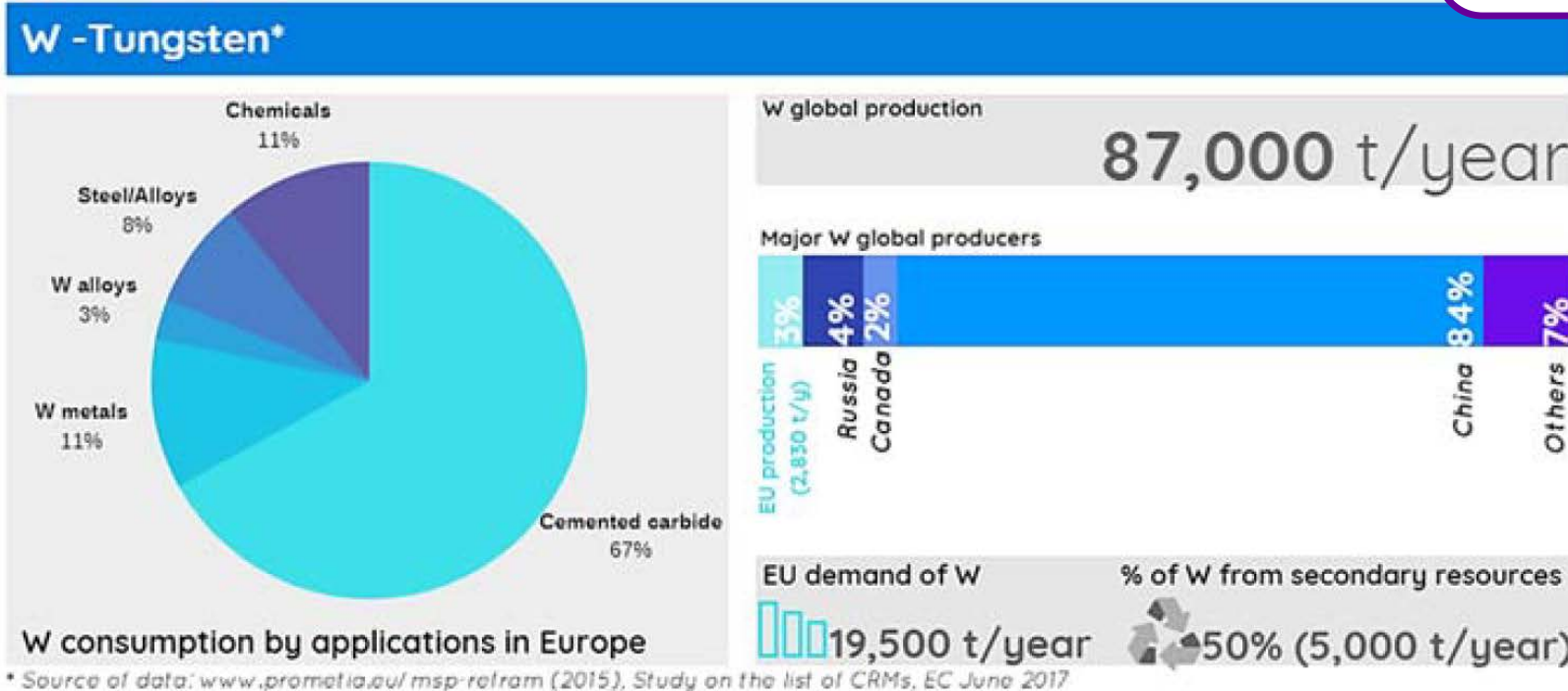
- Why tungsten, tantalum and niobium?
  - Importance of these refractory metals for the EU economy
- The TARANTULA project: aim, technologies, activities
- The TARANTULA benefits

# Why tungsten, tantalum and niobium?

Tungsten, tantalum and niobium are refractory metals that are listed as Critical Raw Materials (CRM) by the European Commission.



Highest economic importance of all CRMs



Scheelite minerals



Tungsten Carbide Drills



Tungsten Carbide Inserts

Sources:  
Tungsten Carbide Inserts and Drills by Cronimet Holding GMBH  
Scheelite Minerals by Saloro



# Tantalum

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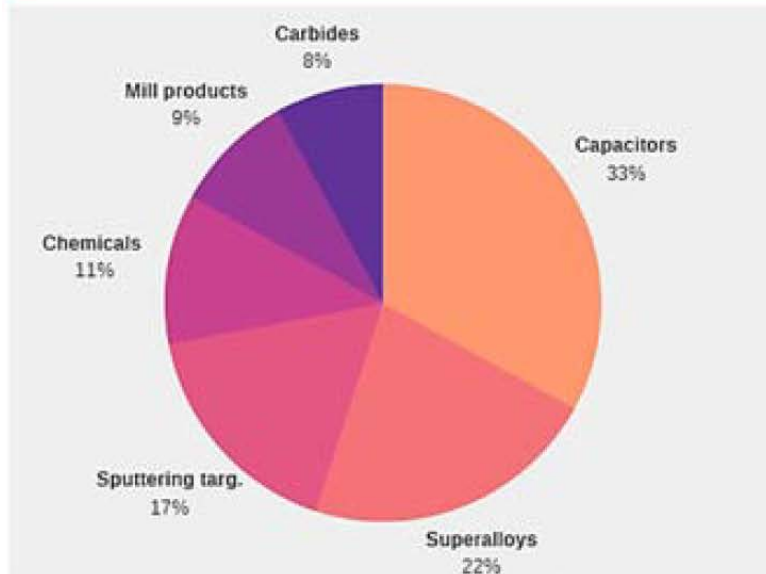
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**Ta**  
tantalum



Highly resistant to wear, corrosion and heat.

## Ta - Tantalum\*



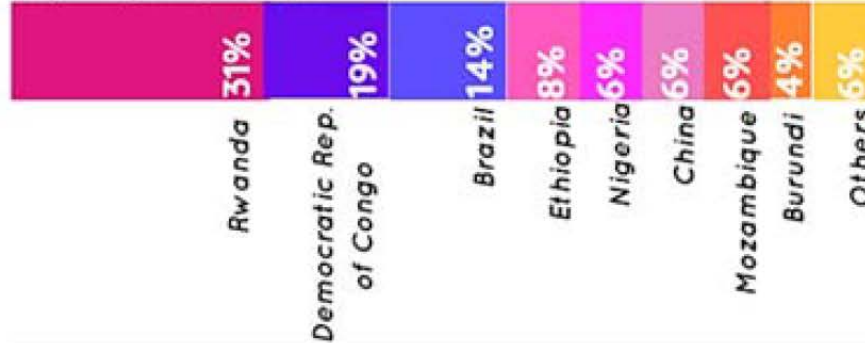
### Ta consumption by applications in Europe

\* Source of data: [www.prometia.eu/mssp-refram](http://www.prometia.eu/mssp-refram) (2015), Study on the list of CRMs, EC June 2017

### Ta global production

1,800 t/year

### Major Ta global producers

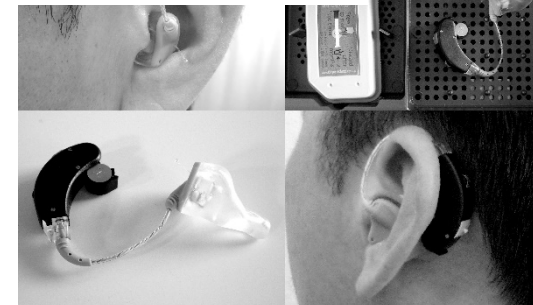
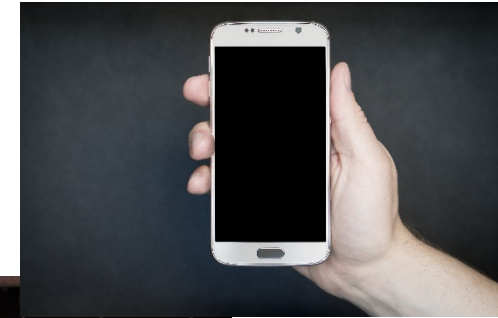
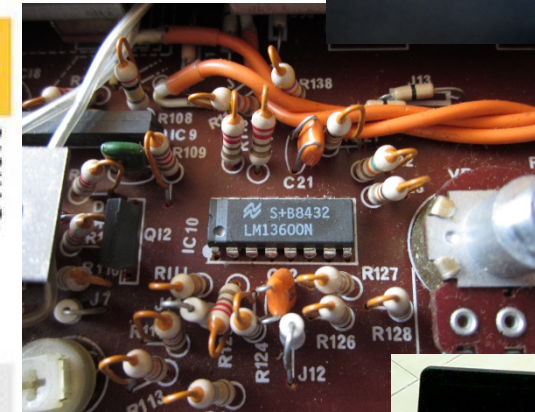


### EU demand of Ta

250-350 t/year

### % of Ta from secondary resources

It is known that in Europe there are companies recycling Nb, but no information on quantities are available.



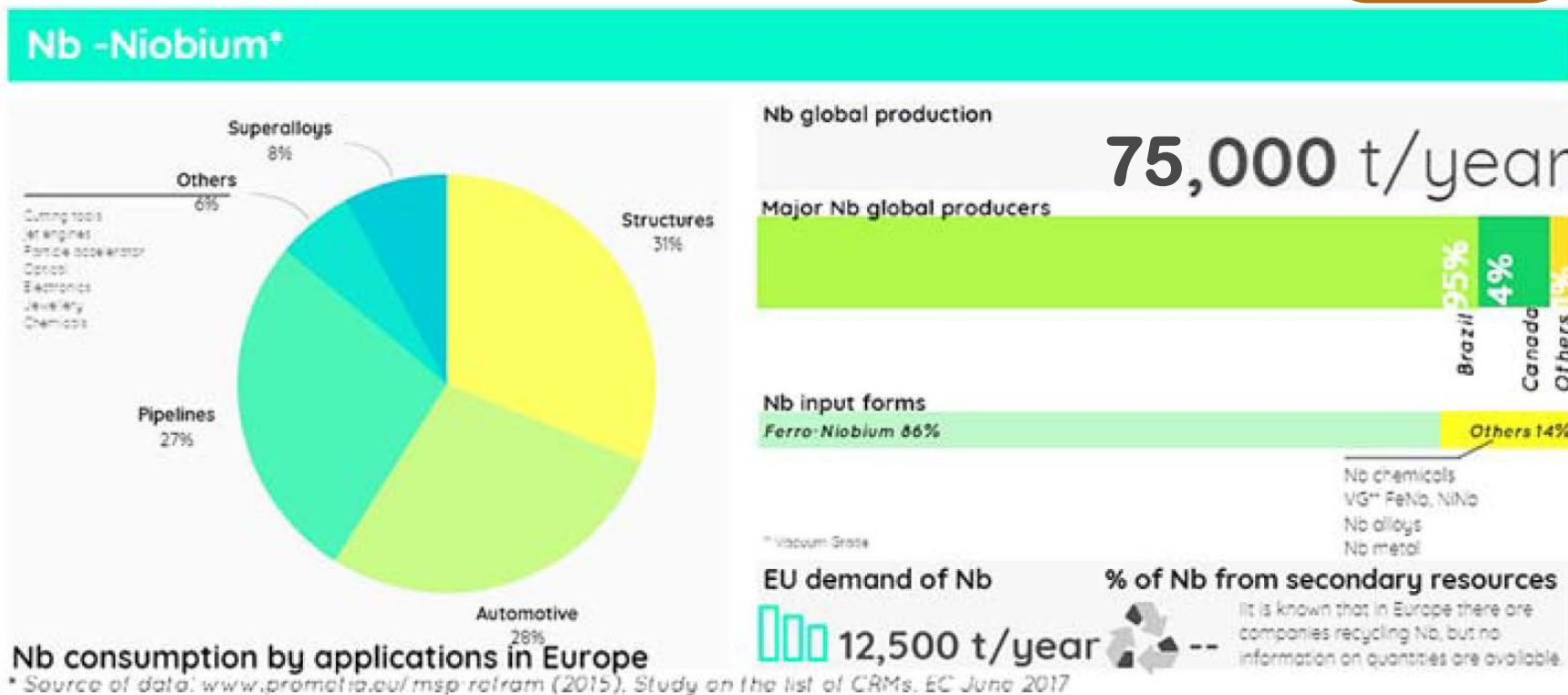
Sources:

"Repair Mistake" by synx508 is licensed under CC BY-NC 2.0

"Hearing aid images" by PlanespotterA320 is licensed under CC BY 2.0

Image by TeroVesalainen from Pixabay

Essential component of high-strength low-alloy steels.

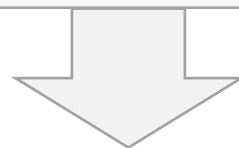


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## The TARANTULA project



**Challenge: exploit potential of W, Nb, and Ta entrapped in complex low-grade resources within EU territory.**



## TARANTULA

“Recovery of Tungsten, Niobium and Tantalum occurring as by-products in mining and processing waste streams”

**Grant agreement ID:** 821159

Coordinator: TECNALIA (Spain)



Ongoing



1 June 2019 – 31 May 2023 (48 M)



6.9 MEUR



16 European consortium partners (companies, industry associations, research institutions and universities) **covering the full value chain.**



FUNDACIÓN TECNALIA RESEARCH & INNOVATION, Spain



KATHOLIEKE UNIVERSITEIT LEUVEN, Belgium



SINTEF AS, Norway



CHALMERS TEKNISKA HOEGSKOLA AB, Sweden



TANTALUM-NIOBIUM INTERNATIONAL STUDY CENTER (T.I.C.), Belgium



SALORO S.L.U., Spain



VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V., Belgium



UNIVERSITE DE LIEGE, Belgium



OPTIMIZACION ORIENTADA A LA SOSTENIBILIDAD SL, Spain



STRATEGIC MINERALS SPAIN SL, Spain



CRONIMET Holding GmbH, Germany



SIDENOR INVESTIGACION Y DESARROLLO S.A., Spain



E-MINES, France



INERCO INGENIERIA, TECNOLOGIA Y CONSULTORIA S.A., Spain



PNO INNOVATION, Belgium



FUNDACION ICAMCYL, Spain

## Goal?

Reduce EU dependence on refractory metal imports by valorizing unconventional European resources. Novel metallurgical technologies are developed to increase the recovery rates and selectivity to finally unlock the metals from resources that are currently considered as waste.

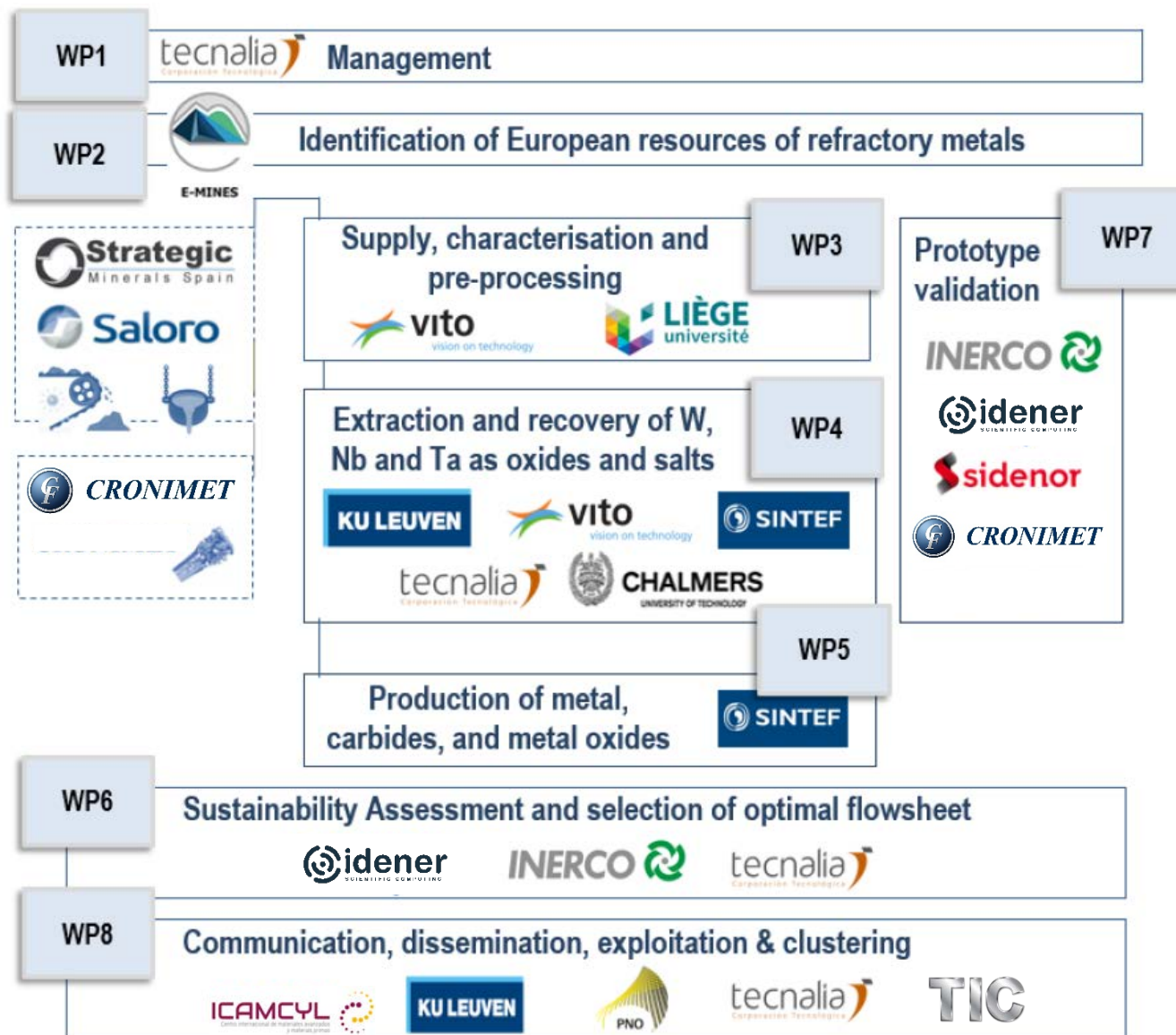
## How?

- Establish strategic industrial partnerships and build a broad overview of W, Nb and Ta-bearing EU resources (WP2)
- Develop a toolkit of novel, efficient and flexible metallurgical technologies for sustainable W, Nb, and Ta recovery (WP3-5)
- Strengthen citizen trust in mineral processing (WP6-8)

TARANTULA focuses on three W, Nb and Ta-bearing EU resources:

- Process residues from the carbide cycle
- Waste from tungsten mining
- Mining & smelting residues from tin (Sn) primary production

Additionally, TARANTULA will expand EU's knowledge of secondary resources with the potential of becoming W, Nb and Ta reserves.



Carbide scraps

Tungsten tailings

Tin tailings and slags





## WP2 - Identification and exploration of European resources of refractory metals

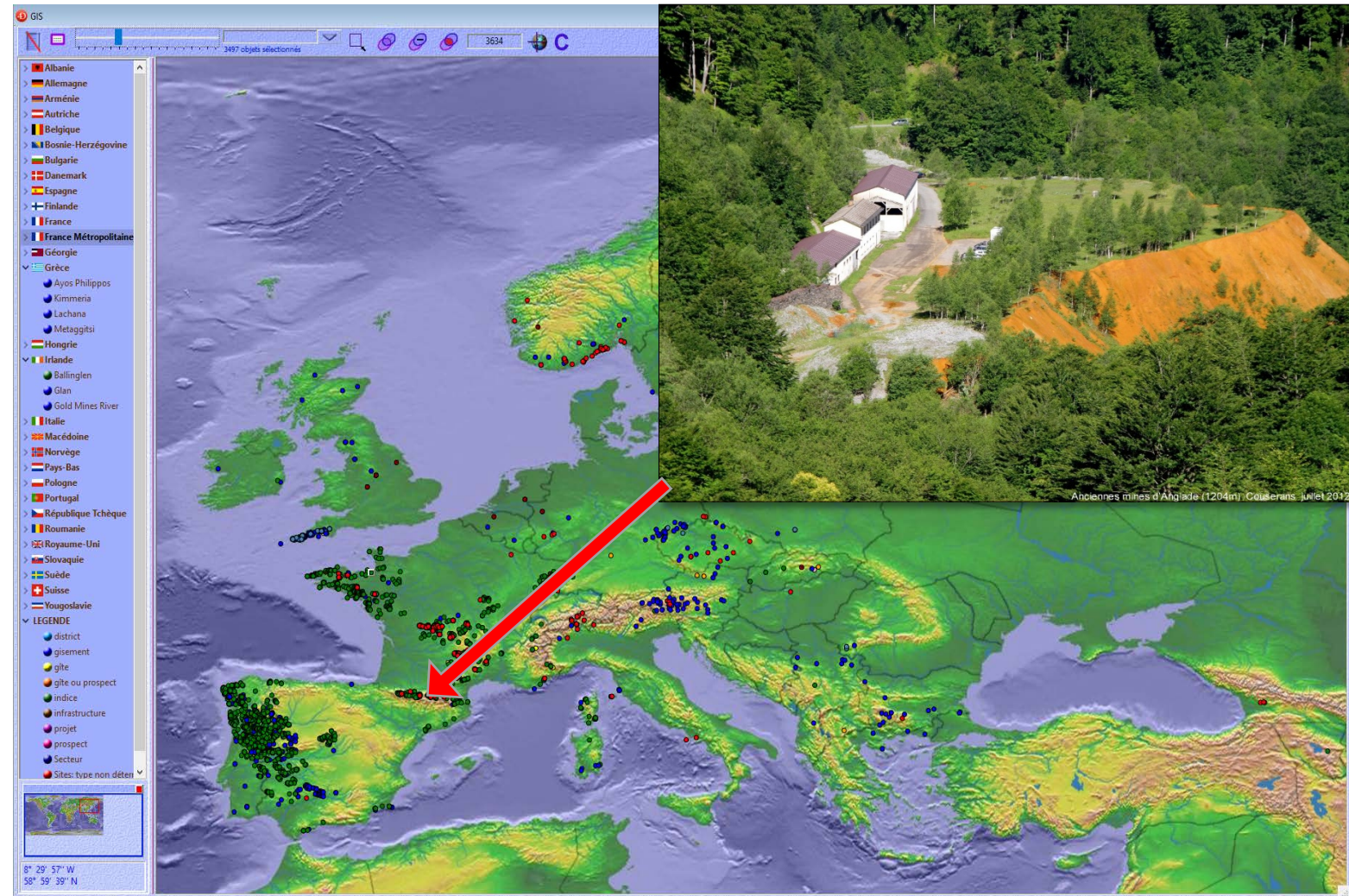
More than 3000 occurrences for W, Nb, Ta known in Europe.

Characterization and selection of the best targets, using:

- Mining databases
- Mineralogical databases
- GKR software

Provide samples and data on the tailings of the Salau mine

- 1 Mt
- 0.4 – 0.6%  $WO_3$
- 1 – 3 g/t Au



## WP3 - Supply, characterisation and pre-processing

Samples of W, Nb and Ta Mine Tailings, Metallurgical Residues and Scraps

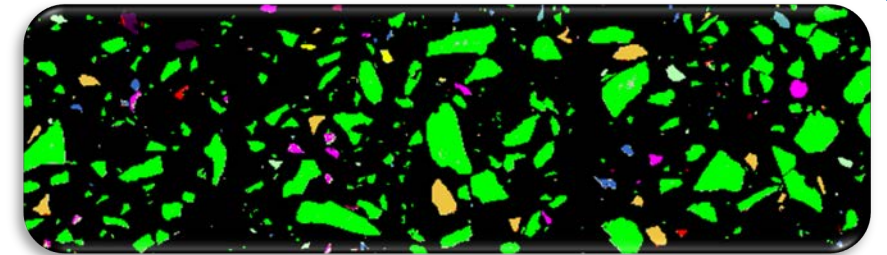
Advanced Characterization Techniques

Development of new Preconcentration Technologies:  
Electro and Microwave Fragmentation - Biomimetic Flotation

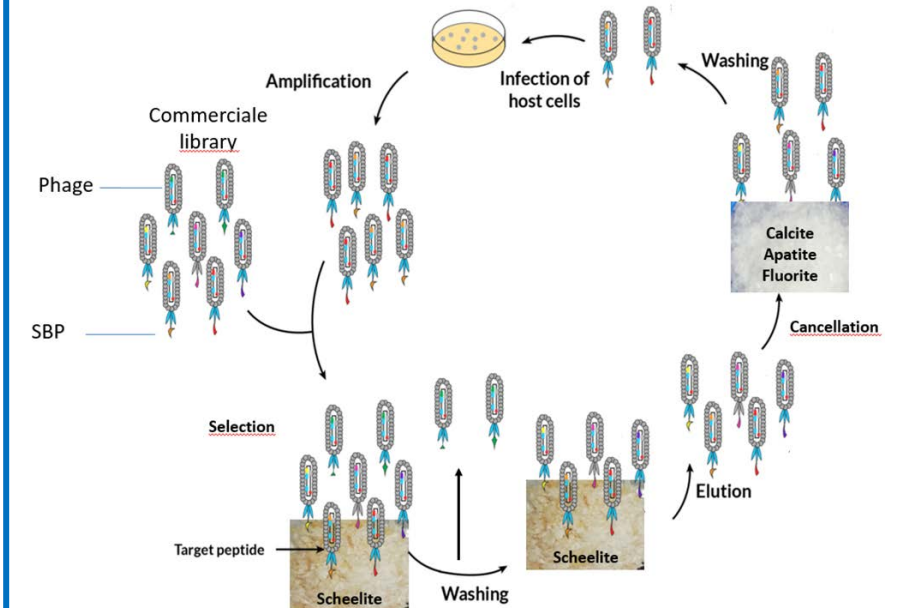
Benchmark against State of the Art

Provide W, Nb and Ta Preconcentrates for downstream Extractive Metallurgy research activities

Deliver preprocessing processes KPIs for LCA



Quantitative Mineralogy of Barruecopardo W Concentrate

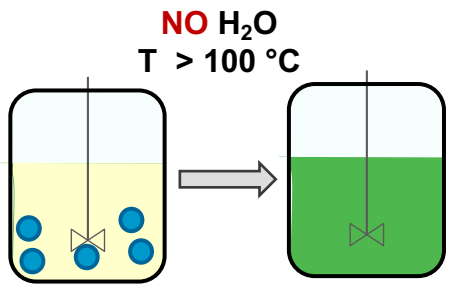


Genetically Engineered Flotation Reagents

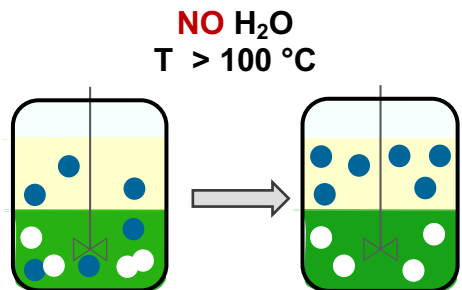


## WP4 - Extraction and recovery of W, Nb and Ta as oxides or salts

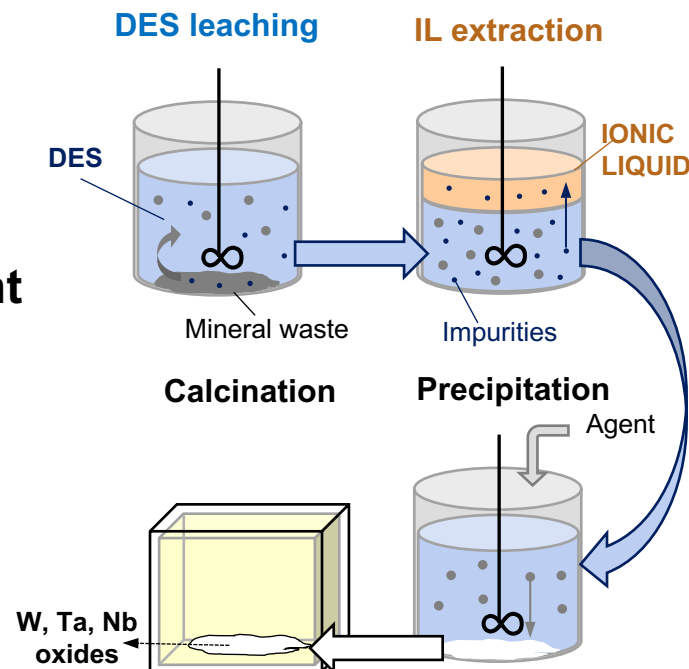
### Solvoleaching



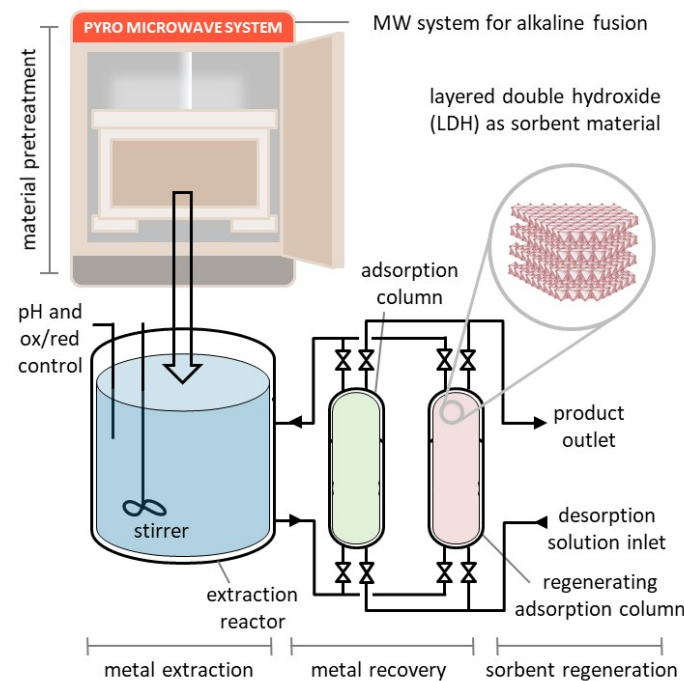
### Non aqueous solvent extraction (NASX)



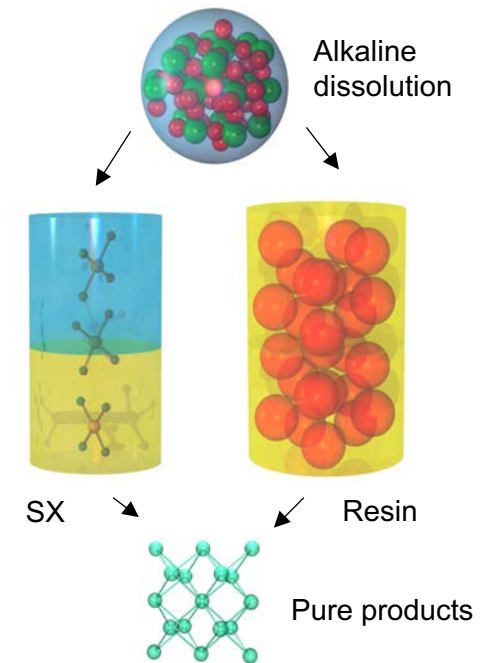
### Deep-Eutectic Solvent leaching and ionic liquid extraction



### Integrated MW assisted fusion and solid phase extraction system

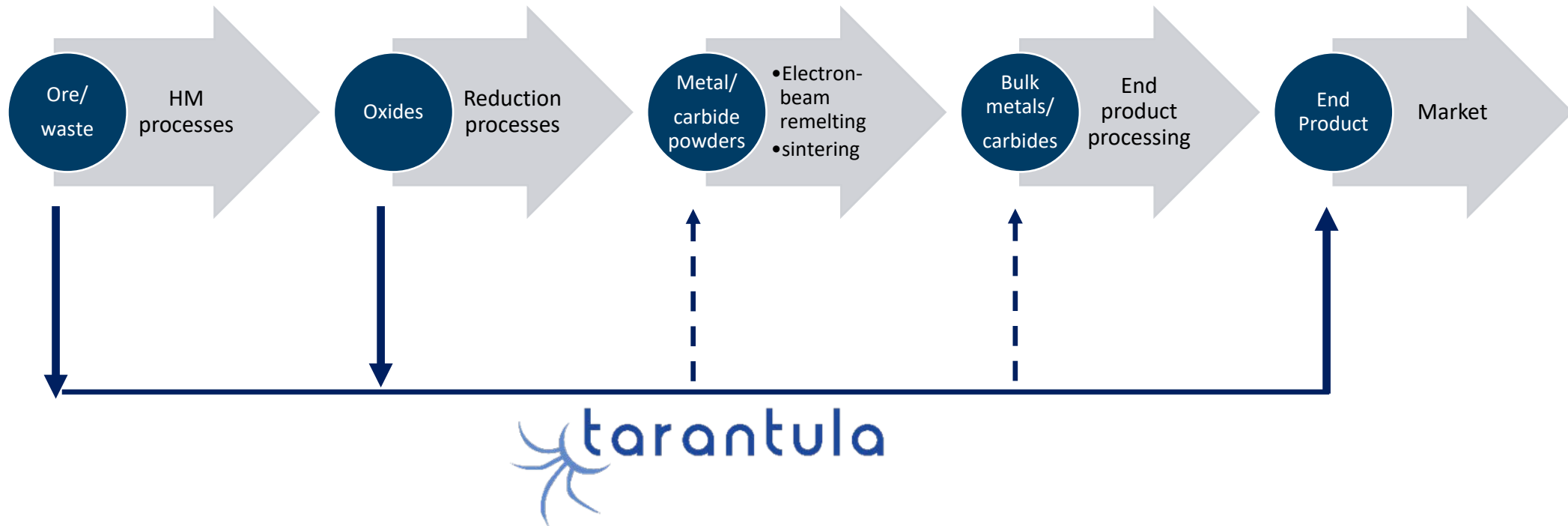


### Selective alkaline leaching followed by chemical clean up and separation



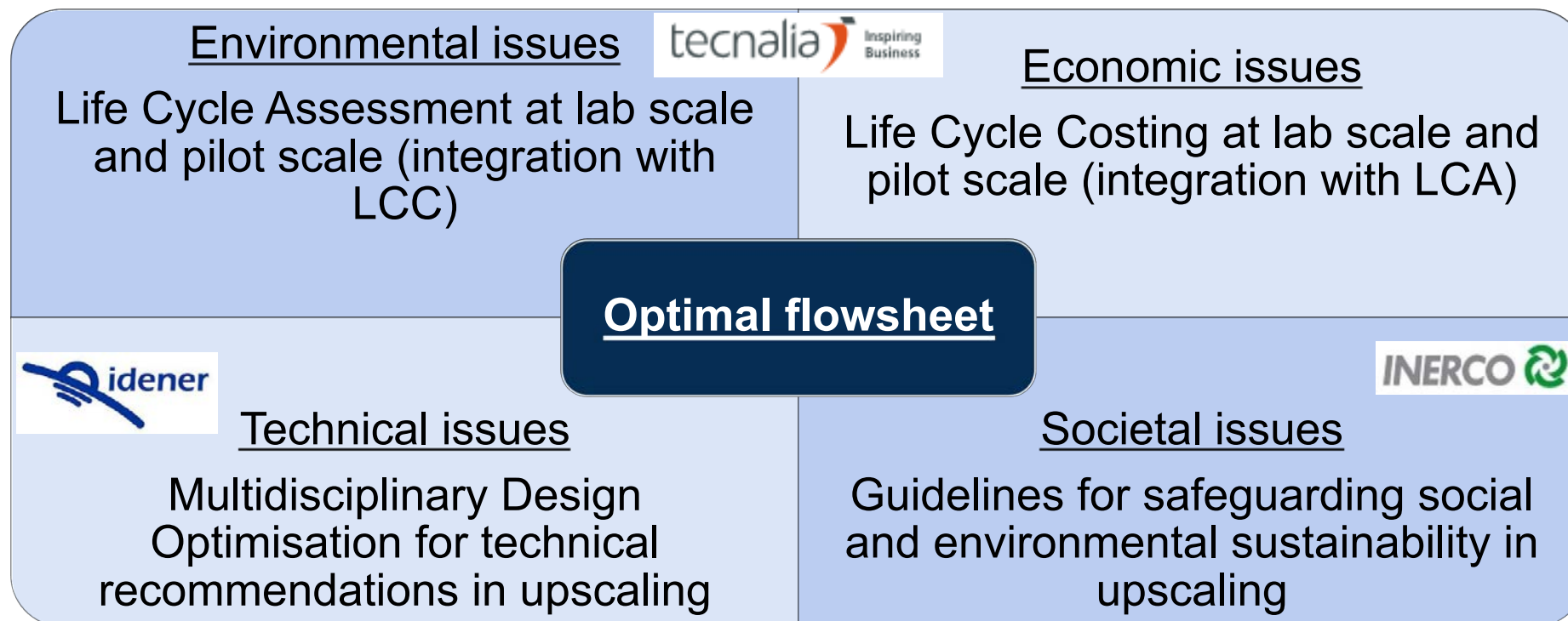
## WP5 - Novel production routes for Metals (M), Carbide (C) layers and metal Oxides (MO) coatings

### From Ore to Metal



## WP6 - Sustainability assessment and selection of optimal flowsheet

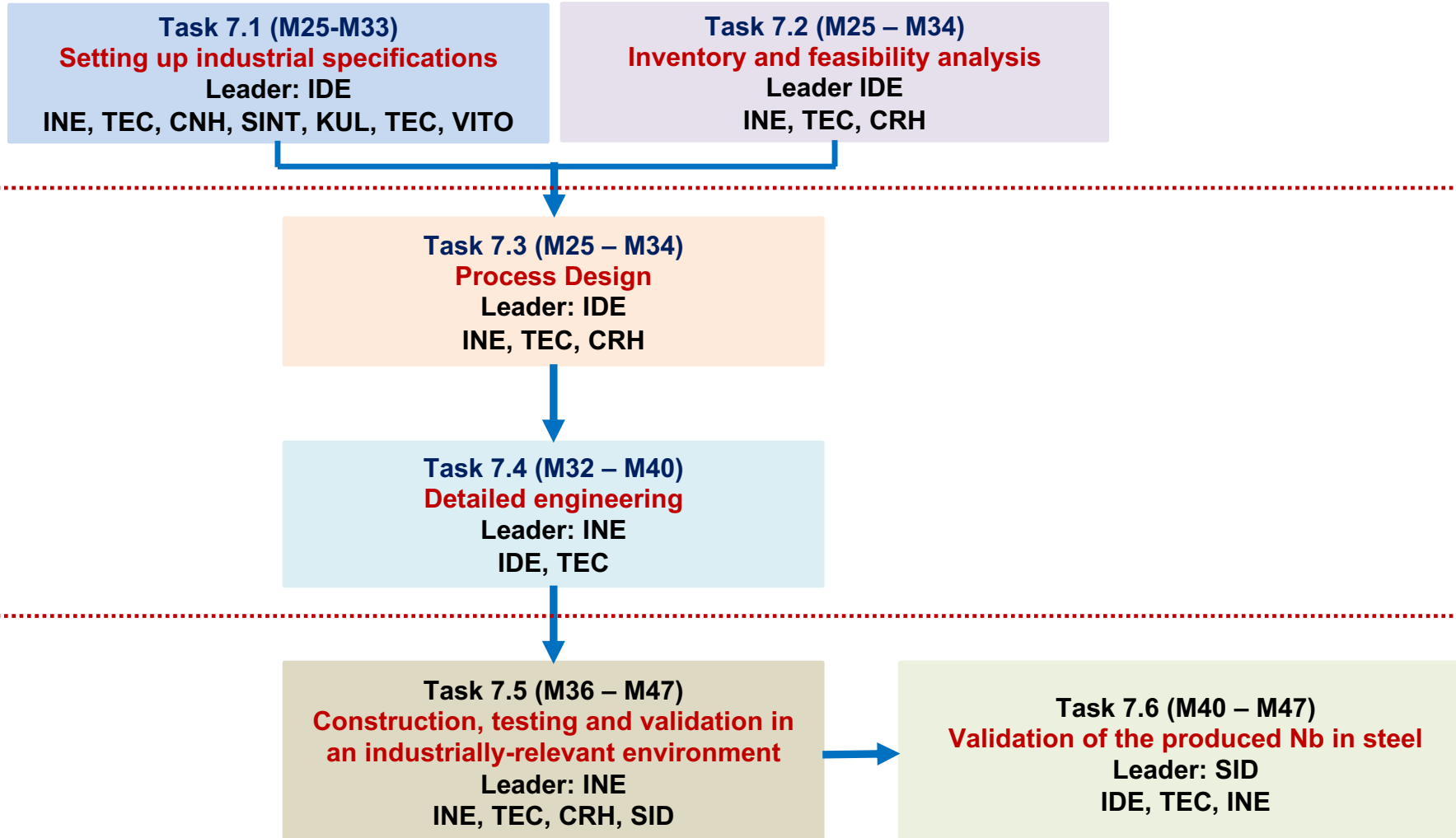
Main goal: assure that technical, environmental, economic and societal issues are appropriately addressed in the upscaling of TARANTULA technologies.





## WP7

### Prototype validation of most promising routes at kg level



Input from WP3, WP4 and WP5:

✓ *Experimental results*

Input from WP6:

✓ *Most promising route for feasibility analysis*

Flow-sheet design

Detailed engineering

Pilot Plant Construction

Process validation

## WP8 - Communication, dissemination, exploitation & clustering

Goal: Pro-active engagement of relevant stakeholders for obtaining and maintaining the Social License to Operate, and to disseminate results in view of maximum exploitation.

### Stakeholder analysis

### Market analysis and Exploitation

Communication and  
dissemination

Civil society engagement

Workshops targeting  
industrial audiences

Clustering

Private sector

Government

Researchers

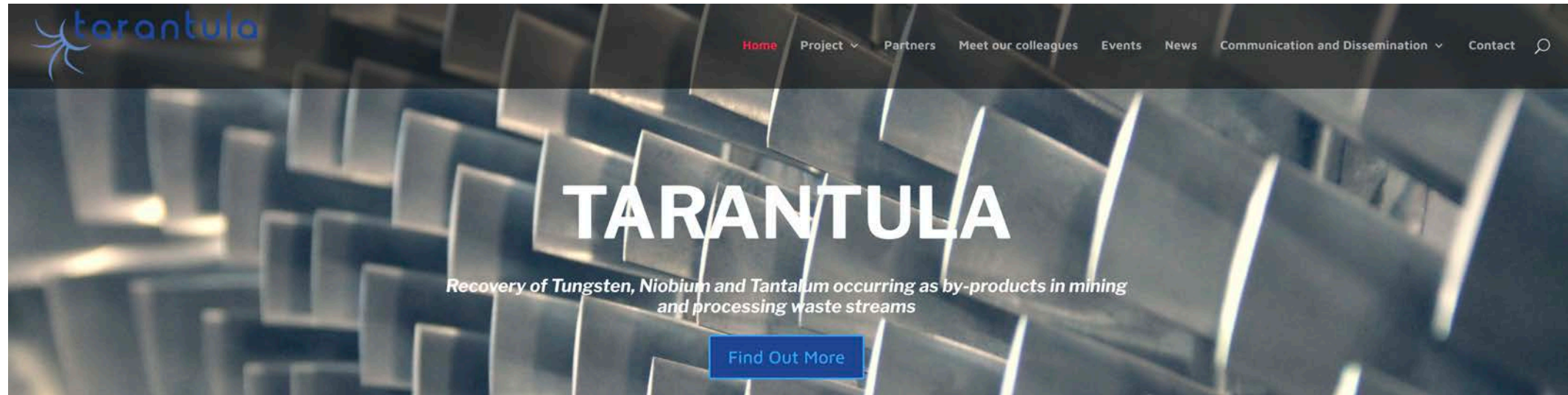
Civil society



- Unlock reserves of W, Nb and Ta trapped in the waste streams
- Reduce dependency of EU from global supply chains
- Technologies with increased recovery efficiency, lower energy costs and environmental impacts
- Increased trust and social acceptance

- Project Coordinator: Dr. Amal Siriwardana (TECNALIA)
- [Amal.Siriwardana@tecnalia.com](mailto:Amal.Siriwardana@tecnalia.com)

<https://h2020-tarantula.eu>



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