

This project has received funding from the European Union's EU Framework Programme for Research and Innovation Horizon 2020 under Grant Agreement No 776473 - https://h2020.crocodile.eu/







The Crocodile project: general information and objectives



Results and innovation potential



Further development: exploitation and business models





General information and objectives







25 partners from 11 different countries

Call: H2020-SC5-2017 Topic: Raw materials Innovation actions

4



First of a kind commercial Compact system for the efficient Recovery Of CObalt Designed with novel Integrated LEading technologies http://h2020-crocodile.eu/



5



- Demonstrate scaled-up innovative integrated systems and technologies capable of enhancing the efficiency of existing raw materials recovery processes;
- > Develop a **new mobile system** with the capability of producing cobalt metal to enable new business opportunities and expand the business across the EU;
- > Build a strong value chain capable of supplying approx. 10,000 ton of cobalt per year (about 65% of the current EU demand) from mainly European resources.











Present situation

 Processes validated at lab scale (more than 90% of Co extraction efficiency in the processes involved)



- Developing detailed engineering for construction of the system
- Revamping of the existing units (restoring and documents including 3D layout)

8



EIT RM Summit 2020, September 30 - EASME session

CRO



9

Innovation Radar: Key Exploitable Results (KER)



	KER	Title	Achievement	Lead partner	Other partners
Pre-Treatment	KER 1	Vacuum treatment furnace	 Improves detection and sorting of Co containing secondary resources Increases Co content in the black mass from spent batteries Reduce energy consumption and environmental impact of recycling processes Patent planned 	ACC	-
	KER 2	Cobalt identification & upgrading		СОМ	-
	KER 3	Sieving methods		AKK	-
	KER 4	Concentration of Co in black mass to 70%		SNA	-
	KER 5	Increase of yield of valuable metals (Co, Ni, Al, Cu) from black mass treatment		SAU	-

10



Innovation Radar: Key Exploitable Results (KER)								
	KER	Title	Achievement	Lead partner	Other partners			
Treatment	KER 6	Solvent extraction process for the extraction and purification of Co	- Innovative process for the purification of Co from deep eutectic solvents by solvent extraction (To be tested in plant under CROCODILE project)	KUL	-			
	KER 7	DES leaching process for metal (Co) recovery from spent Li batteries	 More environmentally friendly process for Co and other metals of interest, with capacity to treat different BM types in mild leaching conditions. (To be tested in plant under CROCODILE project) Protected as a trade secret and patent applied 	TEC	-			
	KER 8	Reductive bioleaching for the recovery of Co contained in limonitic laterites (LAR: FeNi laterite)	 Bio-leaching concept (bacteria as a catalyst) has the potential to revolutionize the processing of limonites with an expected lower capital cost, reduction of energy and reagent consumption and also of waste generation (Patent planned) 	BRGM	BAN, NHM, LAR			
	KER 9	Electrowinning technology for Co metal production	 Possibility of obtaining high-value Co metal product using different Co-solutions with an environmentally friendly technology (Patent planned) 	SIN	GNN			
Pilot	KER 10	Construction of plant	 Realization of plant to treat black mass for cobalt recovery following CROCODILE process (Joint venture planned) 	ECO, IDE	KUL, TEC, SIN, REL, ISL			

Further development: exploitation and business models

11



C R O C O D I L E

Further development: exploitation and business models



1- The CROCODILE consortium is backed up by strong industries along the whole value chain who are interested in the exploitation of the results in their respective businesses

CRO

- 2- A join venture between several partners for the exploitation of the CROCODILE pilot is planned
- 3- A stakeholders analysis identified external stakeholders that can benefit from the technologies developed

4- An initial business plan has been proposed, but will need to be updated after the final pilot design and process upscaling and validation. The business plan can be discussed with potential interested stakeholders by the end of the project, to explore business opportunities with the consortium partners.

Conclusions



- 13
- Processes already validated at lab scale. Detailed engineering, equipment purchasing and plant construction are ongoing.
- 10 Key Exploitable Results have been identified in CROCODILE. These KER have been preliminary defined as potential business opportunities according to the expected level of development at the end of the project.
- The CROCODILE consortium has defined the methodology and elements that form the building blocks of an initial business plan. Further analysis will be elaborated during the project lifetime which will result in an updated business model aiming at the commercialization of the concept.
- There is one patent submitted and it is planned to generate three more. A joint venture for exploitation of the CROCODILE plant is also foreseen.
- > Interest in potential investors/stakeholders that can boost the exploitation of these promising results.

Thanks for your attention

Dr. Lourdes Yurramendi (TECNALIA) Iourdes.yurramendi@tecnalia.com



Dr. Nader Akil (PNO) Nader.akil@pnoconsultants.com

Contact: TECNALIA Dr. Amal Siriwardana (Project Coordinator) Amal.Siriwardana@tecnalia.com



This project has received funding from the European Union's EU Framework Programme for Research and Innovation Horizon 2020 under Grant Agreement No 776473 - <u>https://h2020-crocodile.eu/</u>