Symposium on Social License to Operate for the Mining and Recycling of Critical Metals: Five Lessons Learned

On 21 February 2018 the Symposium on Transitioning to a Low-Carbon Economy – the Social License to Operate for the Mining and Recycling of Critical Metals took place in Leuven, Belgium. The Symposium was part of the Artefact Arts Festival This Rare Earth – Stories from Below, the largest in its kind in Flanders. The event was attended by more than 170 people, with unusually diverse backgrounds, ranging from concerned citizens, to local and international NGOs, public functionaries as well as raw-material experts from industry and academia. The event included several keynote lectures, two panel debates and a speed trip to the Artefact Rare-Earth Related Exhibition. The present article* reflects upon the key discussions that took place and discusses the Five Lessons Learned with respect to the Social License to Operate for the mining and recycling of critical metals, essential for the transition to a low-carbon economy.

Executive Summary the 5 lessons learned:

- **Lesson 1:** Although recycling efficiencies can be very high, with Umicore’s cobalt recycling efficiency exceeding 99%, very low collection rates – for example, just 5% for mobile phones – mean that the overall recycling efficiencies for many critical metals are far below their potential.

- **Lesson 2:** In view of the growing need for critical metals, such as rare earths, lithium or cobalt, for the transition to a low-carbon economy, a significant level of primary mining will remain a necessity, even at hypothetical end-of-life recycling rates of 100%.

- **Lesson 3:** European mines have the potential to supply nearly all Europe’s rare-earth needs for the next 50 years, but local opposition has so far prevented any large-scale mining. For other elements, like cobalt, we will always be dependent on imports, often from countries with lax environmental regulations.

- **Lesson 4:** The mining industry does not rank highly in terms of trust. Being able to extract the critical raw materials from urban mines or new, primary mines will require this trust to be established with local communities.

- **Lesson 5:** The European Commission has recognised the problem and endorsed the concept of the Social License to Operate (SLO). Major new H2020 projects, starting this year, will have to collaborate successfully with local groups when working at several mining sites in Europe. The SLO concept should be refined and made more practical from a European perspective. This is the only way to overcome the NIMBY syndrome.
Key videos & documents from the Artefact Symposium: 21 February 2018

Artefact Symposium testimonial video, which integrates a large number of testimonials and diverse perspectives from the European Commission, academia, industry and civil society: [view here.](#)

All Presentations and > 100 photographs (by Nicolas Herbots) can be downloaded through the Artefact Symposium event page.

Photo, N. Herbots

Opening speech Tie Roefs (Deputy Environment, Province of Flemish Brabant) [Download speech here](#)

Photo, N. Herbots
The sense of urgency with respect to the importance of the transition to a low-carbon economy has never been as clearly articulated as it is today. Taking into account the goal agreed during the UN Climate Conference in Paris (2015) – i.e. “[to keep the] global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius” – this transition cannot be postponed any longer. The required “deep decarbonisation” of our economy implies the rapid implementation of clean energy, efficient energy storage and clean mobility. All these clean technologies have in common that they require significant amounts of “critical metals”, i.e., metals with a high economic importance that simultaneously face a strong supply risk (see EC Critical Raw Material list, 2017; Binnemans & Jones, 2018). For instance, the permanent magnets for wind turbines or electric motors (for hybrid and pure EVs, and e-bikes) require vast quantities of rare earths (like neodymium, dysprosium, etc.). Likewise, energy-storage systems, EVs and e-bikes need ever-increasing amounts of lithium and cobalt for the Li-ion batteries. Emission-control systems in traditional cars, which dominate the market today and will continue to do so for at least the next decade, require platinum-group metals (PGMs) such as platinum, palladium and rhodium.

The question then is: how can we provide sufficient amounts of these critical metals and does their production entail environmental, health and safety risks? How are these burdens spread over the globe? Or can recycling avoid the need for the primary mining of these metals? These questions formed the background to the Symposium on the Social License to Operate for the Mining and Recycling of Critical Metals (February 21, 2018).

1. Critical Raw Material (CRM) recycling efficiencies are still very low

Urban mining and the recycling of critical raw materials (CRMs) from end-of-life electrical consumer goods (e.g., smart phones) and clean energy/mobility applications (e.g., EVs, e-bikes, wind turbines, etc.) is almost by default an environmentally friendly method to generate an independent source of CRMs, which can offset the need for primary mining. In terms of CO₂ footprint, a general rule of thumb is that primary mining generates around 5–10 more carbon emissions than recycling, with the exact number being very metal-specific and dependent on the recycling process. Unfortunately, as became very clear in the keynote lecture (download here) by Umicore’s Egbert Lox, in 2018 the recycling rates for most CRMs are still extremely low. This is not because the metallurgical recycling processes are
inefficient, but rather because recycling requires a complex, multi-step value chain, involving collection, dismantling, shredding and final metallurgical recycling. If the collection efficiency is just 5% – as is the case for the current, global collection rate for mobile phones – then the overall recycling efficiency for metals like Co will also be extremely low, despite the fact that, for instance, Umicore’s Co metallurgical recycling efficiency exceeds 99%. The same is valid for the (neodymium-based) electric motors and (Li-ion) batteries from end-of-life e-bikes, or the electric motors from EVs. Hence, urban mining and recycling are no panacea.

In the first panel debate, Peter Standaert of the Flemish collection & recycling company Ecowerf correctly pointed out the importance of developing sound policy instruments and sticking with clear choices, in order to provide a stable framework that allows us to ramp up the collection efficiencies of end-of-life goods. Katrien Ryckaert of the quadruple helix organisation Leuven 2030, which wants to transition the city of Leuven to a climate-neutral city by 2050, referred to the importance of inspiring story-telling in order to motivate larger fractions of the public to become more engaged in terms of more effective recycling and climate-friendly behaviour.

2. Even 100% recycling of CRMs cannot avoid the need for (a lot of) primary mining

Taking into account that the deep decarbonisation of our economy requires such vast amounts of CRMs – neodymium, dysprosium, cobalt, lithium, etc. – even a purely hypothetical 100% end-of-life recycling efficiency would not suffice. The amount of available CRMs in the present economy is simply way too low to provide this input. Secondly, as EVs and wind turbines have typical lifetimes of 10 to even 20+ years, the contained CRMs only become available after a long period. The schematic figure that tries to depict the circular economy cannot simply be a neat circle with no inputs nor outputs; in reality it needs to have a sigma-shape, as there needs to be a constant feed of new, primary CRMs into the economy. This input is needed to (1) provide the relevant amounts of CRMs for the new low-carbon technologies and to, concurrently, (2) balance the time lag for end-of-life goods to become available for recycling, while also (3) compensating for inevitable losses during the complex recycling value chain (cf., 2nd Law of Thermodynamics).

Egbert Lox (Umicore) illustrated this point for the platinum-group metals (PGMs) and cobalt. As regards, PGMs, Lox pointed out that, at present, 30% of the PGMs that are needed for new automotive catalysts is sourced through recycling. In the best possible scenario this share can be increased to 60–70% in the next decades, which still leaves 30–40% of future PGMs to be provided by primary mining.

For cobalt, which is now often referred to as “the new gold”, the situation is quite similar. The growth rates for the Li-ion rechargeable battery market are astronomical. The main growth driver is and will remain the rapid electrification of mobility. However, the present amounts of cobalt in the economy are still very low, while the end-of-life collection rates for small Li-ion batteries for mobile phones is lower than 5%.
Hence, recycling currently plays only a minor role in the provision of cobalt. Today, more than 65% of annual cobalt production occurs in the Democratic Republic of Congo, of which 20% happens via artisanal, small-scale mining. In the future, the recycling value chain for cobalt will need to be set up, but this will take time, once more implying that cobalt recycling cannot substitute primary mining of cobalt.

The intermediate conclusion is that, provided we believe the transition to a low-carbon economy needs to take place, there is a clear, societal need for the mining of a number of critical raw materials, such as the rare earths neodymium and dysprosium, as well as lithium and cobalt. This brings us to the question where and how this primary mining needs to take place.

3. Western hypocrisy and NIMBY-ism prevails

At present, most of these CRMs are sourced from non-European mines, such as China (rare earths in particular) and the Democratic Republic of Congo (cobalt in particular). European mines for CRMs exist, but they are currently hardly exploited. A good example is the Norra Karr rare-earth mine in the South of Sweden. This eudialyte mine would be able to provide enough critical raw earths for the entire EU industry for at least 50 years (Binnemans & Jones, 2018). The company Tasman Metals has already invested more than 15 years in the exploration and technology development for this rare-earth mine. It received a mining license from the Swedish state and was getting ready for the commercialisation of the mine. However, due to strong local resistance against the mine project, the Swedish state recently revoked the mining license. At present it seems extremely unlikely that this mine will start producing rare earths.

These two examples point to a certain level of hypocrisy. On the one hand, European citizens want to enjoy the luxury of hi-tech electronics (e.g., smart phones) and a multitude of cleantech products (electric bikes and cars, solar panels, clean energy); on the other hand, they do not want these production to occur in “their” backyard. The consequence of not mining Europe’s own CRM ore deposits – through a form of “responsible mining”, said Ka rel Van Acker (KU Leuven) – is that these CRMs need to be imported from non-EU mines. These kinds of mines are typically located in resource-rich countries like China and the Democratic Republic of Congo, where the environmental and health standards are typically not yet as stringent as they would be in Europe. Furthermore, the mining of these metals in such countries does not always happen in the best social and/or human-rights circumstances. Mining conflicts in China, the Democratic Republic of Congo or elsewhere are widespread. Nevertheless, many western people turn a blind eye to this reality, as long as they have cheap access to consumer goods, clean energy and mobility. The parallel with the transfer of CO₂ emissions to the global South, associated with the production of commodities in the South, which
are subsequently consumed in the global North (and which do not appear in the national CO₂ emission accounting system any more), is quite obvious.

4. The Social License to Operate concept itself still needs to gain credibility

In the EU-28 “primary mining does not have sex appeal”, said Marcin Sadowski of the EC (EASME). Sadowski showed a number of opinion polls that revealed how EU citizens perceive different industry sectors. In these EU rankings the mining industry appears in the “relegation zone” of the trust-and-credibility league. This is a genuine problem, not only for the European but also for the global mining industry.

In order to overcome this lack of trust the sectors needs to radically invest in developing environmentally friendly exploration and metallurgical extraction technologies, with a lower carbon, water and chemical footprint. The need for such radical innovation was stressed by a number of panel members, including Kostas Komnitsas (Technical University of Crete, EU METGROW+) and Bart Blanpain (KU Leuven). Several on-going EU Horizon 2020 projects, like METGROW+, SOCRATES, NEWMINE, NEMO and CROCODILE are doing precisely that. The goal is to develop genuinely responsible mining.

Concurrently, the mining sector needs to work hard to obtain and maintain the so-called Social License to Operate (SLO). The SLO has been defined as the “granting of permission to undertake a trade or carry out a business activity” (Nielsen, 2013). The concept refers to the level of acceptance that mining companies receive from public bodies, local communities and broader society. This popularity of the SLO concept follows broader trends in society towards stakeholder and community involvement (Meesters and Behagel, 2017).

However, what became apparent during the closing debate of the Artefact Symposium is that international civil-society groups do not yet fully endorse the SLO concept. In her keynote lecture (download here) Leida Rijnhout (Friends of the Earth Europe) referred to the SLO as an “empty-container concept, which is too voluntaristic and is prone to greenwashing activities by international mining co-operations”. She asked the question of what “acceptance” really means, particularly in countries where democratic structures are not in place. Likewise, Marieke Meesters (Wageningen University) also denoted the SLO concept, describing it as “too ambiguous”. She stated the fact that its translation ‘in the field’ remains problematic”.

Nevertheless, one could also look at the “soft-law” SLO concept on a more metaphorical level. Clearly, the SLO cannot and should not be benchmarked with the official “hard-law” legal mining license a company needs to obtain before starting its activities. Indeed, in the global South, where “the poor sell cheap”, said Leida Rijnhout, asymmetric power relations and the lack of democratic structures may erode the actual value of the SLO. In contrast, in the Western context democratic structures are in place and civil society is highly organised. In fact, I would argue that the SLO concept may be more relevant in an EU mining context.

For instance, the obstruction of both the Norra Karr rare-earth mining project and the Remo Houthis-Kelcharden ELFM case is directly linked to the absence of a fully-convincing SLO. In order to obtain (and subsequently maintain) such a metaphorical SLO for mining projects in the West, the involved companies need to engage with all stakeholders in an open, transparent and continuous dialogue. Group Machiels’ Closing-the-Circle project is an excellent example. Since 2010 the company has been working hard to establish such a multi-actor dialogue with the involved stakeholders, including the so-called “locals” of the Remo landfill site. The questions and remarks of these locals have strongly influenced the technical and non-technical research questions that have been addressed (e.g., initiation of monitoring system at the Remo site). As a result of this 8-year collaboration, the trust of the local communities has steadily grown, as also reflected in their recent contribution at the ELFM IV Symposium in Mechelen, Belgium (February, 2018, download here). However, despite this growing trust and the suc-
cess of this citizen science aspect, the Remo project has still suffered a major legal setback. This is due to the actions of a tiny group of people who continue to resist the project. This shows the limitations of the legal democratic process in Europe, where even one individual can block a social and environmentally beneficial project. How will the SLO concept deal with this kind of situation? Food for thought!

5. The European Commission endorses the SLO concept

On a positive note we can see that at least the European Commission (EC), along with the European Innovation Partnership on Raw Materials, has fully endorsed the SLO concept. This becomes evident in the Horizon 2020 calls for projects that need to develop eco-friendly metallurgical systems for the production, recovery or recycling of CRMs. Nowadays, such calls explicitly force consortia to integrate a clear strategy on how civil society will be engaged in order to build trust in the mining and recycling sector in Europe.

Marcin Sadowski provided a clear overview of how much the EC has been spending on the problem. Likewise, the EC is taking initiatives to discuss the SLO concept during tailored EC-driven workshops, e.g., June 5, 2018: Workshop on Social Acceptance in the European Raw Materials Sector. Furthermore, both the NEMO and CROCODILE EU Horizon 2020 projects, which are set to start in June 2018, will integrate a multi-actor, transition-management framework for the reprocessing of sulfidic mining waste and setting up of an EU cobalt value chain, respectively. The methodology will combine both a bottom-up and top-down civil-society-engagement strategy. Local groups will be set up at several mining sites in Europe. During the course of the projects the SLO concept can be further refined and made more practical from a European mining perspective. This will be the only way to overcome the NIMBY syndrome.

References


Want to react?

You are invited to send your comments to peter.jones@kuleuven.be.

About the author. Dr. Peter Tom Jones is a KU Leuven IOF (Industrial Research Fund) Senior Research Manager in the field of Urban/Landfill Mining and Sustainable Metallurgy. He is coordinator and/or valorisation officer of a number of KU Leuven, Flemish and EU-wide projects and consortia in the field of recycling, metallurgy and Urban/Landfill Mining. He coordinates the interdisciplinary research cluster SIM² KU Leuven, which is one of the core drivers for KU Leuven’s participation in the EIT RawMaterials. He is the author of numerous papers and books in the field of transition management, climate change policies, recycling, metallurgy and Urban/Landfill mining. Since January 2012 he is the President of i-Cleantech Flanders. In March 2014 he was elected to become the General Coordinator for the European Enhanced Landfill Mining Consortium (EURELCO). Jones also coordinates the EU H2020 MSCA-ETN NEW-MINE project on ELFM and will explore the Social Licence to Operate framework in the new EU H2020 NEMO and CROCODILE projects.
The European Training Network for the Sustainable, zero-waste valorisation of critical-metal-containing industrial process residues (SOCRATES) targets ground-breaking metallurgical processes, incl. plasma-, bio-, solvo-, electro- and ionometallurgy, that can be integrated into environmentally friendly, (near-)zero-waste valorisation flow sheets. By unlocking the potential of these secondary raw materials, SOCRATES contributes to a more diversified and sustainable supply chain for critical metals (cf. Priority area 3 in EC Circular Economy Action Plan; COM(2015)614/2).

The SOCRATES consortium brings together all the relevant stakeholders along the value chain, from metal extraction, to metal recovery, and to residual matrix valorisation in added-value applications, such as supplementary cementitious materials, inorganic polymers and catalysts. To maximise applicability, SOCRATES has selected four commonly available and chemically complementary residue families: (1) flotation tailings from primary Cu production, (2) Fe-rich slags from non-ferrous metallurgy, and (4) bottom ashes from incineration plants. As a basis for a concerted effort to strengthen the EU’s critical-metal supply chain for Ge, In, Ga and Sb, SOCRATES trains 15 early-stage researchers (ESRs) in technological innovation: metal extraction (WP1), metal recovery (WP2), residual matrix valorisation (WP3) and integrated assessment (WP4). By training the ESRs in scientific, technical and soft skills, they are the next generation of highly employable scientists and engineers in the raw-materials sector.

Key project information:
Project type: EU H2020 MSCA-ETN
Project duration: 4 years (2016-09-01 to 2020-08-31)
Website: http://etn-socrates.eu/
EU contribution: €3.86 m
Coordination: KU Leuven
Building upon its EIP RMC status and its core role in EIT Raw Materials, METGROW+ develops an industrially viable, flexible “New Metallurgical Systems” Toolbox, which consists of a broad range of already existing and newly developed “metallurgical unit operations”. The unit operations follow a value-chain approach, from pre-treatment, to metal extraction, metal recovery and (residual) matrix valorisation. The industrially-driven, interdisciplinary METGROW+ consortium involves all relevant stakeholders along the value chain, from the (upstream) pretreatment to the final (downstream) residual matrix valorisation in building materials.

The novelty of METGROW+ is twofold:

1. The systems approach (toolbox) to couple the individual unit operations, so as to obtain the most cost-effective and environmentally friendly flow sheet for a given low-grade resource.
2. The development of several new metallurgical unit operations (incl. bio-, solvo- and plasma operations). METGROW+ demonstrates and validates the New Metallurgical Systems Toolbox for a multitude of low-grade resources in the EU-28.
3. Chromium-rich sludges from the stainless steel industry.
4. Fayalitic slags from non-ferrous metallurgy.

The metals valorised from these sources include both economically important metals (Ni, Zn, Cu) and critical metals (In, Ga, Ge, Sb, Co and Cr).

To do this, four low-grade resource families were selected. These are:

1. Primary nickel-cobalt laterite deposits.
2. Iron-rich sludges from the zinc industry.
3. Chromium-rich sludges from the stainless steel industry.
4. Fayalitic slags from non-ferrous metallurgy.

Subsequently to the project and in cooperation with EIT Raw Materials, the “New Metallurgical Systems” toolbox is deployed far beyond the EU Member States directly involved in METGROW+, leading to improved competitiveness and new jobs in the metallurgical and downstream industries, while achieving the objectives of the EIP on Raw Materials.

Key project information:
- Project type: EU H2020 SC5 RIA
- Project duration: 4 years (2016-02-01 to 2020-01-31)
- Website: http://metgrowplus.eu/
- EU contribution: €7.91 m
- Coordination: VTT

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