# Newsletter 2019

IMP@CT: Integrated Modular Plant and Containerised Tools for Selective, Low-impact Mining of Small, High-grade Deposits

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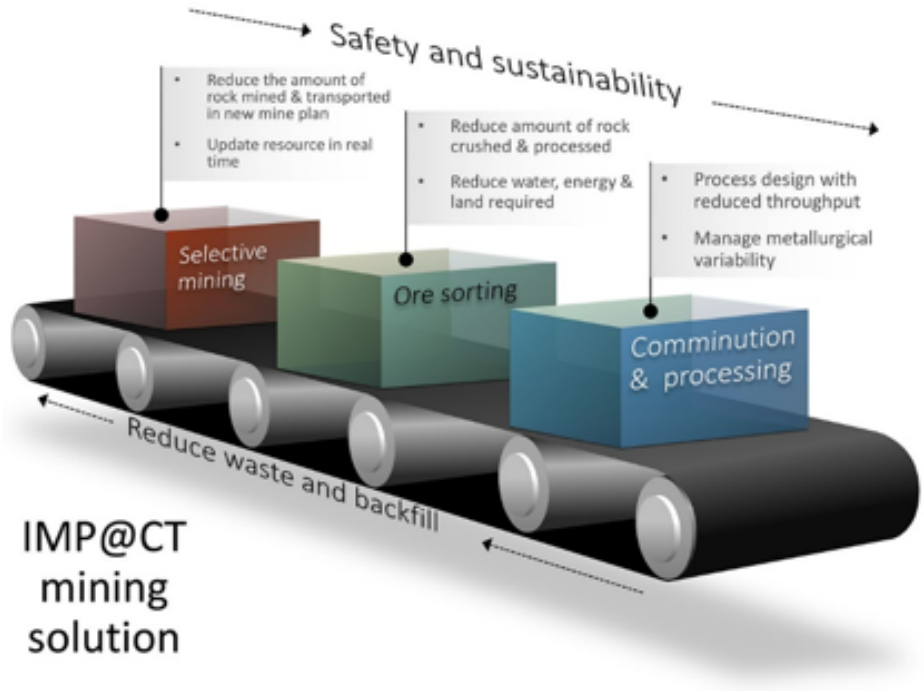
## Editorial *by Kate Moore*

Welcome to the second newsletter of the IMP@CT project, which arrives at the end of an intense period of development and construction, and at the start of an intense period of testwork on mine sites in the Balkans. I am delighted to say that we have made huge progress towards the ambitions articulated in the first newsletter: to advance the technical development of mining solutions, research the sustainability of mining small deposits and illustrate the many facets of whole systems IMP@CT mining solutions.

The technological components of the IMP@CT mining solution have now been realised and are ready for testing and integration at the Olovo (lead cerussite) mine in Bosnia. They include a comminution facility that was completed and deployed to the mine site in July 2018 by project partner Extracthive. This has already been tested and modified into a working solution, ready to be commercialised. The comminution facility has recently been joined by an adaptable and containerised minerals processing test facility which was created by the University of Exeter, with XRF ore sorting capability from Rados International. The test facility is now undergoing hot commissioning on the mine site using prepared stockpiles under the watchful eye of Saeid Moradi, who engineered the plant. You can read more about Saeid's approach to the design, construction, deployment and operation of a containerised minerals processing facility on pages 4-5. Finally, the prototype selective mining tool is being prepared for deployment by Metal Innovations, ready to generate the variable feed that will progress through the whole IMP@CT mining solution. It has already been tested in underground mining situations in the UK.

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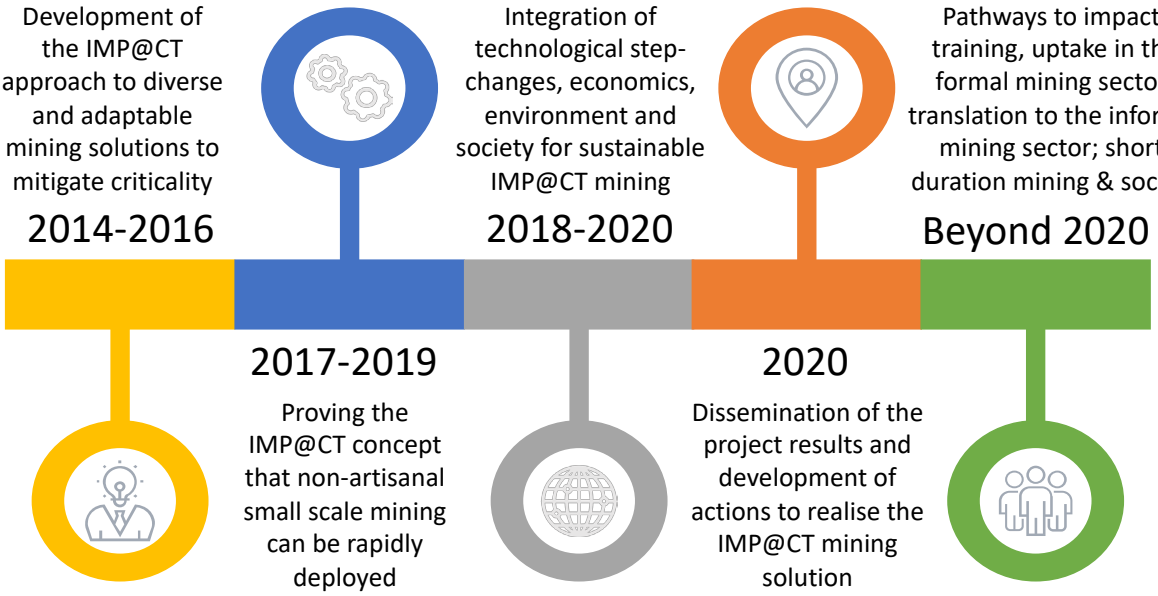
The deployment of the full technical IMP@CT mining solution, from rock face to concentrate, coincides with deployment of the full Mineco processing plant at the start of production. The deployment of two complete mining solutions at different scales at one mine site is an ambitious and carefully choreographed, co-operative exercise that utilizes shared facilities. I would personally like to thank our partner Mineco for their contribution to the project at an incredibly busy time of commercial activity, and for isolating a mineral vein separate from their working mine face for our underground testwork.
The success of modern responsible mining operations in small high-grade ore deposits requires not only technical solutions, but also a comprehensive understanding of the challenges arising for work-forces, environment and society. Geological, metallurgical and societal frameworks have been created to enable further investigations. It is clear from the interviews with researchers on pages 6 to 10 that challenges need to be understood prior to the outset of mine planning, so that solutions can be built into designs for successful small-scale mining operations. Public engagement activities within the mining communities and research led by the University of Eastern Finland into the difference between attitudes towards large-scale and small-scale mining is describe in the interview on page 6. The interview on page 7 alludes to research at the University of Exeter into the parallels between environmental, social and safety cultures as a means to create holistic responsible mining solutions. The research interview on pages 8-9 is concerned with the potential for low-carbon mining by the more extensive adoption of renewable energy in small-scale mining operations, and the interview on page 10 is about research that addresses water quality conducted at RWTH Aachen. Research activities into the sustainability of the IMP@CT mining solutions is now the focus of a stakeholder meeting and workshop in Finland (May 2019).
The coming year is set to be just as busy for the IMP@CT team. We have an ambitious aim to test the adaptability of the IMP@CT mining solution by transitioning from extraction of lead on a working mine site to extraction of antimony from a more remote mine (see page 3 for some more details). Challenges will be mitigated in real-time to simulate how rapidly the mining and processing system can respond to market fluctuations. The testwork at the two sites will provide the data required to develop metallurgical and operational approaches to manage variability in the ore. The whole systems solutions that underpin the project will be integrated using life cycle analysis and other modelling approaches. Moreover, a suite of academic manuscripts are now in preparation for publication that develop the concepts that underpin the non-artisanal mining paradigm, cover the individual technical aspects of short-duration and/or small-scale mining, and demonstrate the benefits of whole systems approaches. To follow the publication trail and progress during the mine deployment over summer 2019, please link to our twitter account @IMPACTmining and look for us at upcoming meetings or conferences (page 12).

## Time-line of creation of IMP@CT mining solutions



# Workshop in Srebrenica, July 2018

The IMP@CT consortium met in July 2018 at a location near to Srebrenica, at the Mineco-owned Grosse Mine where we were shown amazing hospitality by the Mine Directors Jelena and Aleksandar Petrić, and their team. The Grosse mine, is also known as 'Sase' mine after its Saxon history and is located in the northeastern part of the Republic of Srpska, not far from the border with Serbia. The mine is located in one of the largest lead-zinc deposits in the former Yugoslavia, and prides itself on operating to the highest international standards and acting as a community hub. We were delighted to be given a tour of the minerals processing facility there.

We were accommodated in the tranquil and beautiful St. Trojice Orthodox monastery, dating from 1242 and restored after the Yugoslav Wars, and decorated by beautiful traditional paintings of icons. From there were able to explore the environs of the antimony deposits across the border in Serbia, which ceased production due to the conflict. We visited an accessible underground mine to investigate the nature of the mineralisation and the site of mining that was under preparation for mining at Zajača. With more limited infrastructure, the site will be use to simulate a more remote deployment of the IMP@CT mining solution than at our first test site at Olovo in Bosnia. Moreover, the ore is mixed sulphide and oxide ore with harder gangue minerals and host rocks. The processing of the material will require a more extensive flowsheet than that previously used such that rapid adaptation of the test facility will be required. The current status of the site is that it has been cleared and declared technically ready for mining, with operational access and tramway. We further visited a regenerated lead battery reprocessing plant that can also be used to process lead ore, integrating processing of primary and secondary sources of metals in a circular economy.

The hospitality of the team at Grosse mine continued throughout our project workshop and culminated in a homage to the coincident World Cup, with an afternoon of football and basketball at their excellent facilities that are used by multiple teams supporting coaching programmes at local schools. Despite fielding an 8-man IMP@CT team in a 5-a-side game, the highly skilled and professional Sase team showed us how the game is won and we subsequently celebrated with an evening of live music and dancing. It was a great instance of team building, where languages presented no barriers to integration and co-operation.

*Beautiful icon paintings at the St Trojice monastery*

*Left, IMP@CT versus Serbian Miners friendly football match. Above, and below,visit to Zayače mine*

# Saeid Moradi reflects on the process of building a minerals processing test facility

**Agile mining solutions to increase the rate of response of raw materials supply to changes in demand include deployment of containerised equipment with flexible minerals processing flow-sheets. Specifically, this has been conceptualized for small, high-grade deposits that are reasonably well-understood but that have not been subject to extensive exploration and/or metallurgical testwork. What challenges does this create for the design of a minerals processing facility or plant?**

I believe this well-designed mineral beneficiation Plant is not just a new type of Plant with the aim of a much faster response-to-market and better cash flow revenue, but a multi-purpose Plant with considerable operational flexibility. However, this operational flexibility can be varied with respect to the main goal of operating the Plant. It is neither a pilot scale nor a full / industrial scale, but a smart-scale of mineral beneficiation Plant which can generate reliable products and technical & processing information with possibility of future development. In a conventional plant design, a flowsheet is developed during laboratory and pilot studies, and it is practised in a full scale to produce concentrates, but this design enables laboratory to production with much less effort and time. Therefore, this design is a time factor-minded and it supports market timeliness, value of money and short deployment. In operating this Plant, the same design can be rearranged to meet the compatibility of the Plant to different mineral feed types. The design team were constrained by many key factors such as operational flexibility, compatibility with different feed types, containerisation, batch / continuous operation, possibility of future developments, simplicity in both design and operation, health & safety hazards involved, environmental aspects. In addition, the equipment & technology availability, materials of construction, maintenance & installation costs, replacement requirements, small footprint, availability of site service & special labours, and time factors. These factors and also the sequential, or hierarchical, nature of Plant design, all make the design process complex and challenging.

**In your experience, how does the construction of a containerised facility, designed to be adaptable to different ore deposits or commodities, differ from construction of a fully optimized and full-scale processing plant?**

Containerised mineral beneficiation plants are efficient in terms of construction. Construction time is short for containerised Plants, and will not be affected by the weather conditions. Different modules of the Plant can be built off-site incredibly quickly, and joined together for rapid deployment with very much less civil work in the job-site, while in the construction of a Plant at a full scale, first of all, massive concrete foundations are required before erection of structural steel, site-fabricated platework, pre-engineered and modular buildings, and installation of mechanical, piping, electrical and instrumentation. Equipment selection based on size availability on the market and limited space in a container are the biggest challenges in construction of containerised Plants.

**The minerals processing facility is currently being deployed at a case study in Olovo, Bosnia. What do you anticipate the deployment and assembly of the facility, and subsequent test work, will reveal about the loss of optimization and small throughput on recovery rates?**

First of all, the gravity methods are not very efficient, except for DMS with high controllability, which is why they are employed just as pre-concentration methods, where: 1) OPEX should be minimised, 2) simplicity is important, and 3) direct leaching is not viable or environmentally attractive. Separation efficiency of the circuits would largely depend on 1) feed variables such as PSD (particle size distribution), grade and near-density material, 2) how to control operating variable, and 3) working in batch or continuous mode.

**How do you think the facility can be operated to minimize these losses in efficiency?**

The metallurgists can focus to find: 1) the cut-off mill, 2) optimal configuration of the peaks on the cutting head of the selective mining tool for desired cutting of material regarding PSD, 3) how to optimise product of the comminution circuit regarding PSD, 4) optimal configuration of the Plant for a specific mineral feed type, 5) Critical Process Parameters (CPP) which are essential to maintain products within specified quality targets, and 6) how to operate the Plant in a (semi) continuous mode.

*Containerised Plant being loaded at Plymouth (above) In addition there were four crates of conveyor belts to transport (top right). A packing design was produced to ensure all equipment was transported safely, efficiently and as economically as possible.*

*Training the IMP@CT team and students during cold commissioning of the minerals processing test facility at the construction site in Plymouth, UK, March 2019*

# The impact of public perception on the success of mining operations: in conversation with Olga Sidorenko

**The IMP@CT project focusses on establishing how mining can operate competitively on small, high-grade deposits. What do you believe are the societal benefits and challenges arising from this type of mining operation?**

Any new mining project is a challenge to local people, as it brings changes - both negative and positive to their daily life. The mining industry responds to sustainability discourses and strives to maximize positive socio-economic benefits while mitigating potential environmental risks. IMP@CT mining projects in Bosnia and Herzegovina represent relatively small underground mines with small infrastructure. The environmental risks are assessed to be quite small and the project has developed new technology to predict, manage and minimize environmental impacts. However, as in any other community located close to mining, people have certain concerns relating to the environmental safety of mining operations. This means that transparency and good communication between mine operators and local community are important.

From the socio-economic perspective, Bosnia and Herzegovina continue to struggle with long-lasting economic instability and mining is often seen as a solid contributor to the national and local economy. People believe that mine development has the potential to bring employment to rural regions, to increase government revenues and opportunities for local community development. Small-scale mining is, however, quite a short-term activity and does not provide a large number of job opportunities. This is certainly a challenge at the local level, where the wishes for employment can be traditionally quite significant.

**How have you engaged with society in order to understand public perception of mining, in the general case and as it relates to small-scale mining?**

Our research team from the University of Eastern Finland has been working with the issues of public perceptions, social impacts and local governance of mining in different localities for a long time. Our institute follows a social-scientific mining research tradition, addressing the sustainability of mining operations from the local community perspective. We collect and investigate social knowledge to inform policies about views of societal actors and their needs.
The main objective of our research in the community near the IMP@CT project test site at Olovo mine, was to study the potential social impacts of mining. Our qualitative research methods have included in-depth interviews with different groups of stakeholders: in Olovo we had fruitful and informative discussions with local farmers who live close to mine, representatives of local businesses, teachers, fishermen and leaders of smaller communities.

**What are the general outcomes from your public engagement activities?**

We believe that an understanding of people's concerns and overall attitudes towards new mining operations is essential at the start of any new sustainable mining operations, as it facilitates the prediction of possible hotspots for resistance in company-community relationships. The study in Bosnia helped to reveal the questions of social acceptance of new small-scale mining operations that differ from conventional large-scale operations. By combining our results with those from other IMP@CT Work Packages, we aim to articulate opportunities to enhance the benefits of small-scale mining technology development for local communities.
If small-scale mining becomes economically and geologically viable and is extended to other parts of Europe, our study will also contribute to more in-depth understanding of the factors that affect attitudes towards small-scale mining.

**The communities that you have been working with are located in a post-conflict region. How do you think this has affected attitudes towards mining?**

One of the outcomes of the violent conflict in Bosnia has been an increased focus on ethnicity as a major element of identity of communities. This complicated the post-conflict recovery and added a sense of fragility to ethnic issues. However, the town of Olovo is today a place where community identity builds across ethnic borders, and other identities such as "neighbour", "colleague", "fishermen", "miner" achieve greater significance.
In the case of Olovo, we also observed that attitudes towards mining are greatly affected by the history of mining development in the area. Local community members, to a large extent, associate themselves with mining and perceive the place as a "traditional mining town", where mining is just being restarted after a break. During the new mining development, we might see how history influences current attitudes towards mining.

# Health and safety in small-scale mining operations by Keiran Doyle

**Can you describe the possible employment scenarios for non-artisanal, small-scale mining operations, and the accompanying benefits and challenges in health and safety culture?**

Establishing and maintaining employment prospects and job security for local communities living near to small-scale SOSO (switch on – switch off) mining operations is a vital consideration for ensuring social sustainability is maximised. The technological dependency of this new mining style limits the direct employment opportunities for local people, due to the skill requirements of those positions. However, careful planning at the feasibility stage can establish the local employment potential of the region immediately surrounding the intended mine site. This understanding can help to inform management decisions to either directly employ a certain number of local workers, or instead promote job creation and business start-ups in those local areas. Effective training strategies tailored to less experienced personnel as well as skilled operators will be essential for small-scale mining, in order to reinforce occupational best practice by using health and safety culture as an underlying principle

**What do you believe to be the relationship between individual employees and employers in the development of health and safety best practice? How might this relationship be affected by the scale of mining operation?**

When it comes to health and safety in modern mining, only the highest standards are acceptable. If best practice health and safety is going to be maintained indefinitely, particularly in small-scale SOSO mining operations, then permitting and encouraging employees to freely voice occupational safety concerns to management without subsequent prejudice or complacency is critical. It is my belief that operating on a smaller scale than traditional mines will allow mutual trust to be established more rapidly, due to the significantly reduced number of employees being managed. So, eliminating the hierarchical paradigm and corporate culture that is typical of traditional operations may help to forge best practice standards in occupational health and safety from the outset.

**What activities have you undertaken to build health and safety into the design and construction of the IMP@CT mining solution?**

My main involvement in IMP@CT from a design and construction perspective has been to consult with the original equipment manufacturers (OEMs) on how ergonomic principles can feed into the final optimisation of their designs. Primarily this has been undertaken to mitigate the risk of immediate harm, such as injuries from falling objects, trips and falls, etc., as well as prevent the onset of latent safety concerns, including musculoskeletal disorders and silicosis. The main principles of ergonomics, addressing machine control design, access & height, confined spaces, manual handling and so on, have also informed documentation produced for IMP@CT OEMs outlining best practice design criteria, which have helped to guide the final stages of construction of our Mobile Modularised Plant and Selective Mining Tool.

**How do you see that health and safety culture can or should be integrated with environmental and social sustainability considerations in responsible mining solutions?**

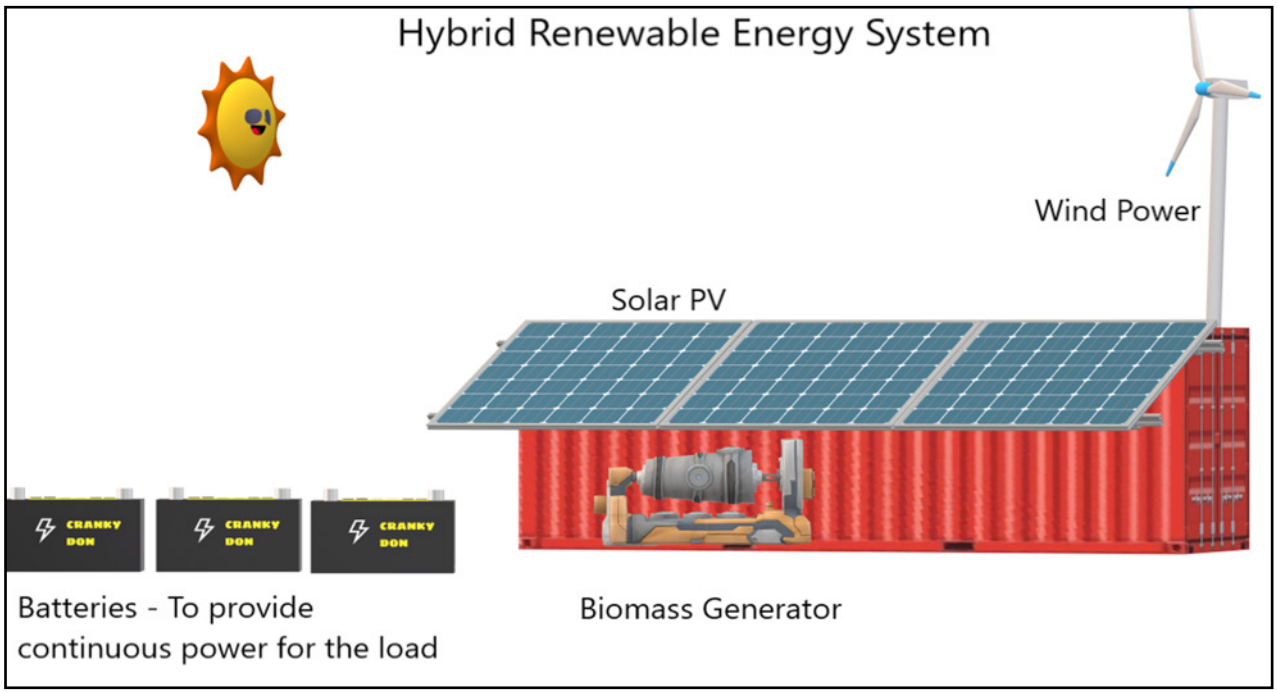
Safety culture has been well-established as a major leading indicator of workplace accidents, and is defined as the prevailing attitudes and perceptions by management and employees towards occupational safety issues. Given the growing prevalence and severity of environmental and social (E&S) issues in industry, particularly in mining, a socio-environmental approach to risk can be translated across mining projects, in order to maintain high safety standards. Therefore, the concept of E&S culture can be an important tool for providing companies with a clear idea of how to work towards cultural excellence in safety, by striving for environmental sustainability and building mutual trust and understanding with local communities. This can be achieved by first establishing baseline E&S culture using a 5-level model, with associated criteria that outline the characteristics of a company at each level. This criteria can then be used to guide strategies for improving safety culture with incremental, achievable goals, thereby moving towards a paradigm of responsible mining.

# Anshul Paneri provides an overview of renewable energy options for future mining operations in Europe

**What are the limitations to the use of renewable energy in mining operations, and how extensively is renewable energy currently used in the global mining industry?**

Several factors are responsible for the limited integration of renewable energy in mining. Intermittency is one of the significant technical roadblocks to the use of renewable power generation. Mining projects require an uninterrupted power supply, whereas renewable resources are not constantly available to generate power. Thus to provide continuous power, energy storage or other power generating systems have to be incorporated and further increase the system cost. Project location and installation area can further limit the integration of renewables for mining. A mining project can be located in areas where the weather may be less suitable for solar and wind generation. The difficult terrain of a project can restrict inclusion of a renewable-based generation system that has high land use intensity. High capital expenditure is a financial roadblock to the use of renewable energy. The investors always want to reimburse initial capital expenditure as quickly as possible. Furthermore, fossil fuel subsidies restrain the use of renewables for mining. There are tax exemptions on fuels for off-road operation and energy generation making renewables less attractive than fossil-based generation.
Even with the limitations to renewable integration, there is substantial growth in the use of renewables for mining. After the Paris agreement, the mining industries are focusing on reduction in greenhouse gas by adopting renewable power generation. Currently, there is 1 GW of renewable generation installed on mines, and another 1 GW is in the pipeline to be installed on mines (1). The mines with existing renewable power generation can save millions of pounds in diesel fuel cost and reduce tonnes of $CO_2$ emissions per year.

(1) Natali P, Haley K. Insight Brief Toward Sustainable Mining 2017




*The Hybrid containerised system utilises different renewable generation systems combined to provide the required power. For the IMP@CT project a similar strategy can be followed to provide the energy demand while keeping the system mobile. In the diagram solar PV, biomass and wind turbines provide renewable power, and batteries are used for storage to overcome the intermittency of renewable energy.*

### How may a reduction in the scale of mining operations be amenable to an increase in the relative contribution of renewable energy to power solutions?

The contribution of renewable energy for mining entirely depends on the availability of renewable resources in comparison to conventional power generation. If there is already an existing grid connected to the mining site, then the renewable power generation can be expensive with low availability of renewable resources. Whereas with the availability of high renewable resources, the mining site can generate large amounts of power with lower renewable installation and thus cheaper power than the existing grid. In off-grid generation, availability of renewable resources is compared with diesel fuel and economic feasibility is devised to find the optimum contribution of renewable to replace diesel fuel.

The scale of mining can affect the relative contribution of renewable energy. For example, a small scale mine has lower power demand in comparison to a large scale mine. With the availability of high renewable resources, renewable energy can contribute to a higher percentage. Whereas for large scale mines with high power demand, higher renewable contribution might not be economically and technically feasible.

### What is the potential for reliable energy provision for mining in Europe from renewable sources?

In general, Europe has the availability of biomass (forest and agricultural waste), solar and wind resources. Depending on the location the renewable resource availability changes. For example, south-west Europe, particularly Spain, has an abundance of solar energy with a moderate supply of wind and biomass resources. In contrast, the north of Europe in areas such as Scotland has excellent wind resources and average biomass resources. Eastern and central Europe have an abundant supply of biomass resources.

### How may an initially more expensive renewable, or hybrid diesel-renewable, energy solution be offset by the environmental and long term economic gains?

An Advancement in renewable technology has led to a significant reduction in the overall cost of renewable generated electricity. Even with high capital expenditure, the renewable generated power is cost-effective when compared with only diesel-based generation over the designed period. The cost-effective renewable electricity can be attributed to minimum operation cost in comparison with a very high operating price for diesel-based generation systems. The volatile diesel fuel market further brings economic instability in the system. In the current economic climate, a renewable or hybrid diesel-renewable system can be economically beneficial and save millions of pounds in diesel fuel costs for an only diesel-based generation system. In terms of environmental gain, fossil fuels are responsible for increased $CO_{and}$ emissions in the atmosphere leading to global warming. Decarbonising the electricity generated from fossil fuels and switching to green renewable-based power generation will help in reducing tonnes of $CO_2$ emissions.

Along with environmental and economic gain, renewables can also provide social impact near the project area. Mining sites are mostly found in regions where there are no existing grids. In such cases, the power generation is primarily dependent on diesel-based generation systems. Once the project is finished the generators are also moved along with the other equipment. Leaving behind diesel generators provides expensive power for a local community since they have high operating costs and does not result in adequate economic gain. However, renewable based power plants can be left for the local community, providing clean and cheap electricity. Thus renewables can also provide a social gain for the local communities. Renewables like biomass can further provide socio-economic gain by developing a circular economy for the local communities.

# Marjan Knobloch describes her research addressing water quality in a small-scale mining context

**Why is it essential to understand the environmental properties of a resource prior to any extractive process?**

For every mining project, whether large- or small-scale mining, it is important to analyse the geology, geochemistry and mineralogy of a deposit with regard to possible environmental impacts that exist during the exploration phase, in order to minimise or avoid possible risks. This is an integral part of modern mining and it was not always the case in the past.

**Why are predictive tools of particular importance in a low-CAPEX mining approach with a small budget for exploration and an intention to extract the highest grade ore at the outset of operations?**

Predictive tools are important not only to estimate and avoid possible future risks. In the past, it was often the case that environmental tests were carried out during the operating phase of a mine, which has also to do with the fact that many conventional tests are elaborate, lengthy and not feasible in-situ. Missing or delayed results on the properties of mine waters can result in significant cost increases, costs which were not calculated in advance.

**What is the work that you have been doing to develop new tools for the prediction of water quality?**

The aim was to develop a predictive field-based tool that is cost effective, rapid and easy to use with existing technologies, which find new applications. The developed method is a visualisation of the reactivity of sulphides in ore samples, because sulphides are the main trigger for acid mine drainage.

**How widely do you think that your predictive tool could be used both within and outside of the mining industry?**

Since the prediction tool is about the analysis of sulphides, this method can be also used for geological issues to detect the presence of sulphides in general, where conventional methods fail due to the technical detection limits. Therefore, it can be used wherever information on mineralogy, in particular on the presence of sulphides, is required.

# News in brief

Above; construction of the selective mining tool is almost complete, at Metal Innovations' workshop in Wales. The machine is aiming for deployment at the Olovo site in June 2019.

Below; a workshop was held in May 2019 Finland with the stunning scenery of Koli as a backdrop. A full report will be available on the website and in the next Newsletter.

Above; accommodation for IMP@CT members when visiting the site at Olovo. Owing to a shortage of hotel accommodation we have rented a house locally for the duration of activities.

Below; on site, the groundworks include laying electric cables to provide power to the IMP@CT Plant.

# Conference round-up 2018 - 2019



The IMP@CT Consortium has been very active in promoting its activities in the last twelve months.

The First International Conference MINES OF THE FUTURE, AIMS 2018 was held at RWTH Aachen on 23-24 May 2018. The IMP@CT Project held a special session during the conference which was well attended, and consisted of two Keynote speakers – Dr Kathryn Moore and Dominic Roberts, and five further presentations from IMP@CT partners as well as posters, and participation in a panel discussion on the subject of "Mines of the future need to be different from those of today?"
Dr Kathryn Moore (UNEXE) "The emerging niche of small-scale mining" (Keynote address)
Dominic Roberts (MINECO) "The Future of European Mining" (Keynote address)
Guillaume Bertrand (BRGM) "IMP@CT baseline database for 'switch-on switch-off' extraction"
Olga Sidorenko (UEF) "Reconsidering small-scale mining and its community relations in Europe: developing a research frame for case studies in Bosnia and Herzegovina"
Luke Palmer (UNEXE) "Definition of mineral respurces during exploration and exploitation in a 'switch-on switch-off' mining context"
Lars Barnewold (RWTH) "Development of a mine pan for a flexible switch-on switch-off mining system in steeply dipping deposits"
Jerome Bodin (BRGM) "Linking mineral processing simulation with life cycle assessment to evaluate the potential environmental impacts in the framework of small-scale mining technologies development"
Saeid Moradi (UNEXE) Poster: Designing the IMP@CT modular mobile containerised mineral processing plant
Marjan Knobloch (RWTH) Poster: Prediction of the acid and metalliferous drainage-forming potential for the Gorazde antimony deposit, Bosnia-Herzegovina
Marius Braun (RWTH) Poster: Ventilation systems for future mining operations

*Clockwise from top left: IMP@CT Consortium members at AIMS, Aachen, 2018; Guillaume Bertrand of BRGM presenting at AIMS; RFG18 in Vancouver, Canada; IMP@CT Consortium members at 3rd International Critical Metals Conference, Edinburgh, 2019.*

Other conferences that included IMP@CT presentations were;
RFG (Resources for Future Generations) 16-21 June 2018. Kate Moore presented on the technical and ethical approaches being taken in the IMP@CT project.

IAIA (International Association for Impact Assessment) 29 April – 2 May 2019. Rauno Saurinen presented on the cumulative impacts of small deposit mining in Bosnia and Herzegovina.

The Mineral Deposits Study Group Annual Meeting 2019 Various IMPaCT members gave presentations and posters.

3rd International Critical Metals Conference 2019, Edinburgh - presentations from Kate Moore (sustainable mining of critical raw materials), Anhsul Paneri, (renewable energy potential) Keiran Doyle (Health and Safety).

Pablo-Brito-Parada disseminated the results of the metallurgical studies at the International Mineral Processing Congress (IMPC) September 2018 in Moscow, Russia and the Expert Forum on Fine Particle Flotation and Sustainable Use of Water in Mineral Processing organised by EIT Raw Materials, January 2019 in Dresden, Germany.

Kate Moore gave an invited presentation to the Cornish Institute of Engineers and a Public Lecture to the Geological Society in London 'The role of the Geologist in Securing Suppiles of Critical Raw Materials', which is available at https://www.youtube.com/watch?time_continue=4&v=b-fCx8mMtXY, which focussed on IMP@CT.

# Final Stakeholder Meeting and Conference, 2020

*Heartlands Mining Heritage Site, Cornwall*

*The spectacular Cornish coast, with Botallack Mine*

The IMP@CT consortium will present the main project accomplishments of the project at a final meeting in 2020. The meeting is planned as a multi-faceted series of workshops running in parallel with a dissemination and outreach exhibition and prgramme of art workshops that will be open to the public. A busy and full programme of presentations and break-out workshops will be based around results from the IMP@CT consortium, the challenges that have been faced and the opportunities that have been identified. We will examine the technological developments and the socio-environmental investigations that formed the core of our project. We will investigate how these may be used to understand the potential to roll out a more diverse set of mining solutions in the future, linking with other H2020 mining-oriented consortia. And we will invite stakeholders to discuss the implications and opportunities arising from the project, beyond 2020.
The themes of the four-day meeting are:

- Communication of modern mining practices in collaboration with a cohort of artists, with workshops open to schools and the public;
- Uptake and expansion of small-scale mining practice in the formal mining sector;
- Translation of small-scale mining practice designed for European contexts to the informal mining sector;
- Short duration mining, environment and society.

Heartlands is an important World Heritage Gateway Site in the mining landscape of West Cornwall. Accommodation will be in local hotels on the beautiful Cornish coast and transport to the meeting venue will be provided.

Please follow us on Twitter for more details: @IMPACTmining

## Other conferences where we will be found in 2019 and 2020

- 14th Nordic Environmental and Social Science Conference: Social Science in our time. Luleå University of Technology, 10-12 June 2019. https://www.ltu.se/org/ets/Avdelningar/Samhallsvetenskap/NESS2019/14th-Nordic-Environmental-Social-Science-Conference-Social-Science-in-Our-time-1.176768?l=en

- AIMS 'Mines of the Future', 13-14 June 2019 in Aachen, Germany: https://www.aims.rwth-aachen.de/

- SGA 'Life with Ore Deposits on Earth', 27-30 August 2019 in Glasgow, Scotland: https://www.sga2019glasgow.com/

- PDAC annual convention, 1-4 March 2020 in Toronto, Canada: https://www.pdac.ca/

Please follow us on Twitter for more dates: @IMPACTmining

For more information about IMP@CT, or to be added to our list of stakeholders please contact info@impactmine.eu