

International Copper Technology and Research Hub

Concept report

Stage 1 - July, 2016

A game changing vision to support the South Australian Copper Strategy.



Contents

Executive summary	06
The hub's role	09
Copper Development Roadmap	12
Hub stakeholders	13
An overview of potential hub activities	14
Hub's focus in the mining innovation landscape	18
Value proposition to key stakeholders	19
Hub business model	20
Management and governance	21
Intellectual property	22
Next steps	22
Attachment 1: Stakeholder meetings to date	23
Attachment 2: Collaboration models considered	23

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Copper is a key metal for the future, offering major advantages for new and developing technologies.

Executive summary

A game changing vision to support the South Australian Copper Strategy.

South Australia's Copper Strategy sets a bold target to triple copper production over the next 15 years, with the aims of driving economic growth and increasing investment and sustainable job opportunities. A major action arising from the strategy is to investigate establishing an International Copper Technology and Research Hub (the hub) in South Australia. This paper recommends a way to establish the hub based on information provided by key stakeholders.

HUB VISION

ACCELERATING THE PRODUCTION AND VALUE OF COPPER PRODUCTS FROM COMMERCIAL ORE BODIES AND DRIVING GLOBAL COMPETITIVENESS.

This vision underwrites the industry:

Adopting world-class technology and best practice approaches to reduce capital and operating costs.

Delivering world-class level of productivity.

Improving environmental and safety performance.

The hub will strengthen the South Australia's copper industry and is expected to attract worldwide interest. It will be a magnet for world-class technology and innovation, leveraging the mineral resources partnership with the Chilean Government and the Australian Government's National Innovation and Science Agenda including the METS¹ Ignited Industry Growth Centres, CSIRO and Adelaide's Universities. The hub can provide a focus point for aspiring and existing METS suppliers to the copper industry, and act as a showcase to trail and test new technologies.

1. METS – Mining Equipment, Technology and Services



A Copper Development Roadmap will focus the hub's priorities

A Copper Development Roadmap (the roadmap) will be prepared, with stakeholders, before the formal establishment of the hub, to frame the hub's work priorities and direction. The roadmap will seek to identify key opportunities that will enhance and accelerate the development of the South Australian copper industry.

Hub location

The hub will feature the best attributes of a physical centre together with partners from South Australia, Australia and internationally. The hub centre is proposed to be at Tonsley, Australia's first innovation district.

The hub business model

The mining industry is typically cyclical in nature. The hub's business model should be robust and capable of sustaining and growing activities through all stages of the economic cycle.

A compelling value proposition for all stakeholders

Stakeholders will benefit in a variety of ways:

Access to high level skills, awareness of the latest in global technology and market trends and the opportunity to demonstrate innovative technology solutions.

Access to global METS technologies and suppliers, key research providers and industry partners.

Provide key directions and understand the business needs of the mining industry.

An opportunity to be part of the expansion of the copper industry in South Australia.

An opportunity to be engaged and participate in setting a bold agenda for delivering the Copper Strategy target and hub activities.



Next steps

Next steps in the development of the hub include:

Forming an interim Hub Steering Committee, to drive the development of the hub's business plan and formation

Generating the Copper Development Roadmap, with participation from key stakeholders

Developing a preliminary business plan for the first five-year period

The hub's role

South Australia's Copper Strategy (the strategy) sets a bold target to triple copper production from South Australia over the next 15 years, with the aims to drive economic growth and increase investment and sustainable job opportunities.

To ensure success of the strategy, three action themes have been identified. Each theme has a series of practical and achievable actions that will deliver the strategy's vision:

"by 2030, South Australia will be the major contributor to Australia's position as the world's third largest copper producer."

The three themes are:

1. Exploration, discovery and information
2. Developing innovation infrastructure services and research
3. Building industry and community capacity

A major action in theme two is to investigate establishing an International Copper Technology and Research Hub (the hub) in South Australia. This paper provides a suggested approach to establish the hub.

The hub will aim to enhance the focus on commercial technology development and its application. It is recognised that leading practice technology and approaches will help the industry operating in South Australia to be a world leader.

The hub's success and vision will be built on collaboration with stakeholders. Broad consultation to date (Attachment 1) indicates that the following working vision could be supported.

HUB VISION

ACCELERATING THE PRODUCTION AND VALUE OF COPPER PRODUCTS FROM COMMERCIAL ORE BODIES AND DRIVING GLOBAL COMPETITIVENESS.

This vision underwrites the industry:

Adopting world-class technology and best practice approaches to reduce capital and operating costs

Delivering world-class level of productivity

Improving environmental and safety performance

The hub aims to be a game changer in the approach to commercialisation and implementation of technology into the copper industry. The aim is to position the industry for long term global competitiveness at the bottom of the cost curve.

While the hub will strengthen the South Australia's copper industry, it is expected to attract worldwide interest and be a magnet for world-class technology and innovation from both the mining industry and beyond (Figure 1). The hub will develop strong linkages with global METS providers and miners, for example companies operating in Chile will be encouraged to participate in the hub. Participants will be able to benefit directly through these collaborations. Existing international agreements, such as the mineral resources partnership with the Chilean Government, will be enhanced through the hub.

The hub also supports the Australian Government's National Innovation and Science Agenda. The agenda encourages the best and brightest minds to work together to solve key challenges, where inter disciplinary and collaborative approaches are required. The hub's vision is closely aligned with new the Australian Government Industry Growth Centre, METS Ignited.

METS Ignited is a recently established industry-led, government funded organisation whose mission is "to improve the global competitive advantage of the Australian mining equipment, technology and services (METS) industry, nationally and globally, and to position Australia as the global innovation hub for METS."² Fundamentally the hub will be positioned to develop and deliver commercial outcomes for the stakeholders, and work areas will be supported by a compelling business case.

The hub will work closely with the METS Ignited Growth Centre and particularly in the development of best practice for copper mining and processing. The hub approach is very much consistent and supportive of the 'living laboratory' concept being developed by METS Ignited. Deeper copper deposits, coupled with complex mineralogy and lower grades are global challenges. The hub would directly tackle and benefit from generating and implementing solutions to these challenges.

In addition to stakeholder input, the design of the hub proposed in this paper has been informed by considering existing collaboration models both in Australia and globally (Attachment 2).

2. Taken from Mining Equipment, Technology and Services (METS) growth centre strategic direction

Figure 1: The International Copper Technology and Research Hub will be a magnet for key stakeholders in South Australia and globally.



Copper Development Roadmap

It is proposed that a Copper Development Roadmap (the roadmap) will be developed before the formal establishment of the hub, to frame the hub's work priorities and direction. The roadmap will be developed in collaboration with stakeholders, and form the basis for a plan in line with the strategy. It is expected that all programs and activities will be supported by a strong business case, including a plan for how to progress the technology through the development pipeline.

The roadmap will seek to identify key opportunities that will enhance and accelerate the development of the South Australian copper industry. The road mapping exercise will seek to establish a prioritised set of objectives and milestones for the hub to focus.

Focus areas to be covered:

Technology developments to address challenges and opportunities in deep mining and processing of complex ores

Leading practices for accelerating resource project management and more effectively managing project risk

Providing stakeholders with market trends and methods for evaluating the commercial potential of new products and processes

Research on engagement with community and stakeholders

Innovation and tech solutions in safety and environmental performance.

These focus areas, while addressing South Australia's unique copper environment will be equally relevant to solving challenges relevant to the global copper industry – deep cover over ore bodies, complex mineralogy and removal of impurities.

The roadmap will be a live document with a timeframe in line with the strategy, with annual targets and milestones. This will enable progress monitoring and reporting back to stakeholders.

It is proposed that the hub stakeholders contribute to the development of the Copper Development Roadmap.

Hub stakeholders

The hub will engage with and support a range of existing stakeholders in the copper value chain (Figure 2). It should also attract and introduce a new range of stakeholders. Possible stakeholders include, but are not limited to:

Exploration, mining and production companies in South Australia

Exploration, mining and production companies considering investment in the South Australian mining industry

International copper producers and METS

The CSIRO has a strong and vibrant presence and is seen as a key enabler of progressing the hub's objectives

Australian Nuclear Science and Technology Organisation (ANSTO)

METS suppliers to the mining industry, both current and new

Universities from South Australia³ and other Australian states

Cooperative Research Centres (CRC) i.e. The CRC for Deep Exploration Technologies and CRC Ore. A broader range of CRCs may also become participants

Global research and industry groups, i.e. Centre for Excellence in Mining Innovation in Canada

Engineering groups

Technology suppliers, including non-traditional suppliers to the mining industry

Communities involved with mining either directly or indirectly

METS Ignited

The International Copper Association

Copper users and manufacturers

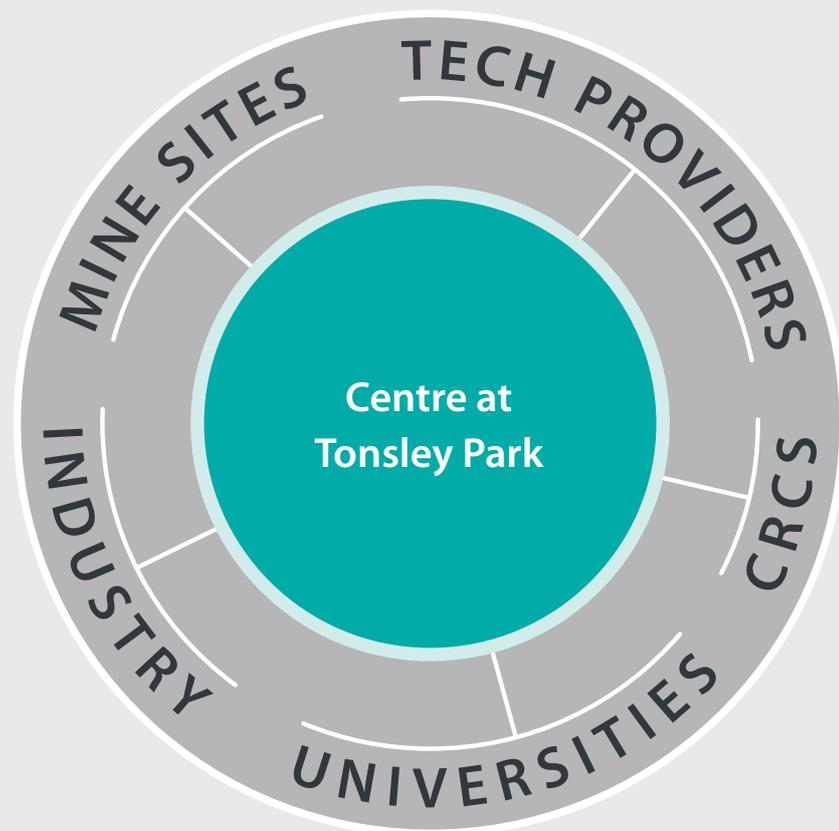
Particular emphasis will be placed on encouraging new technology suppliers that may not have previously considered the mining industry as an attractive market.

3. Both university technology departments and business schools would be encouraged to participate. In the latter case to assist in developing commercial plans for technologies and also in understanding future market trends for copper.

An overview of potential hub activities

The hub will feature the best attributes of a physical centre together with partners from across South Australia and globally (Figure 3). Feedback suggests it is important for the hub to have a physical component, to act as a focus point for stakeholder interaction. The hub's stakeholders have a wide range of existing world class resources which will be utilised rather than duplicated. The hub centre is proposed to be at Tonsley, Australia's first innovation district.

Figure 3: A hub and spoke model is proposed, with the centre based at Tonsley.





Tonsley

Tonsley is a major South Australian initiative and is Australia's first innovation district bringing together leading-edge institutions and companies to connect with start-ups, business incubators and accelerators in a high-value industry, research, education and residential precinct. Tonsley will provide an ideal location to base the hub centre, supporting a high degree of partnering and collaboration to optimise the value chain⁴.

4. METS Ignited refer to "living laboratories", which has a number of related features.



The hub will undertake a range of activities (Figure 4), which are framed according to the priority areas identified in the Copper Development Roadmap. Further details are provided in Table 1.

The hub will leverage existing and future partnerships with international organisations and producers, such as the mineral resources partnership with the Chilean Government.

Figure 4: The hub to focus on areas shaped by the Copper Development Roadmap

WHAT IS THE HUB?



STATE-OF-THE-ART FACILITIES



KNOW-HOW AND TRAINING



NETWORKING



SKILLED PEOPLE



FINANCING



TECHNOLOGY BUSINESS CASE AND COMMERCIAL IMPERATIVES

TABLE 1: SUMMARY OF HUB POTENTIAL CORE ACTIVITIES



Custodian of the Copper Development Roadmap:

- Lead the application of the roadmap through the input of key stakeholders
- Implement the agreed set of priority areas and work programs.
- Maintain and report against the roadmap.

Provide state-of-the-art facilities

- Access to world class facilities and equipment.
- Access to networked stakeholders facilities at the CSIRO and universities.

Collaboration and networking

- Facilitating collaboration between key stakeholders. Provide focus for technical exchange and collaboration between research providers, innovative technology companies and suppliers, original equipment manufacturers and end users.
- Widen the technology lens to include technology suppliers not traditionally associated with the mining industry.

Knowhow and training

- Leading practice training.
- Provide a high level technology monitoring process, and keeping hub stakeholders up to date with best practice copper technology.
- Equipping stakeholders with tools for developing the business case for new technologies and approaches.
- Provide state-of-the-art training facilities, including virtual reality training of mining and mineral processing activities.

Co-location of start-ups

- Incubation hub for start ups
- Attract technology start-ups to be co-located at Tonsley, focused on the South Australian mining industry but also with global aspirations. A start-up fund could be established to assist start-ups and SMEs to develop technology specific to copper production.

Best commercial practice

- Developing capability in analysing global trends in copper supply and demand.
- Assist in the development of best commercial practice for structuring and funding mining activities from preliminary scoping studies right through to production and sales. The emphasis is to devise strategies for reducing development times while maintaining acceptable risk profiles.

Undertaking projects

- Focus on the uptake and implementation of existing best practice, and support the successful implementation of “close to market” technology by providing suitable testing platforms.
- Draw upon the existing expertise and equipment of stakeholders, and fill infrastructure gaps (e.g. suitable pilot plants and the like) to test and develop new processes.
- Provide technology developers and SMEs with a supportive platform for technology development and collaboration.
- Extending best practice community engagement for resources projects.
- Best practice in environmental performance.

Hub's focus in the mining innovation landscape

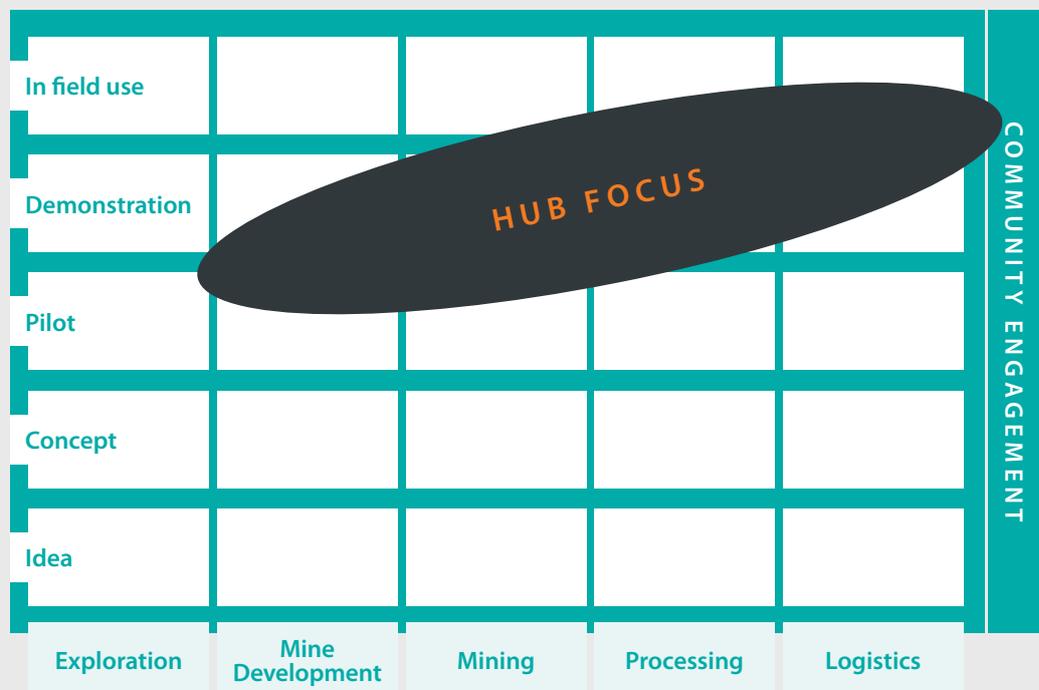
Feedback from stakeholders indicates the hub should focus on technology development and demonstration (Figure 5). It is understood that formation of concepts and proof of testing is vital in the innovation process, however early phases in concept development are already represented by existing key stakeholders.

The hub will focus on the key stage between research and technology implementation. This covers the critical stage between where a new technology has been conceived and tested on the small scale, but then needs to proceed to pilot testing and beyond. The hub will directly assist technology developers and technology users to cross the pilot and demonstration phases.

While the Copper Development Roadmap will confirm the hub activities, initial ideas are to focus on:

- Resource characterisation and imaging
- Mining practices
- Mineral processing
- Community engagement
- Environment, safety and logistic activities

Figure 5: The hub will focus particularly on pilot and demonstration testing of new technology⁵



5. The stages covering pilot and beyond can also be described according to Technology Readiness Levels (US Department of Defence). Pilot and beyond is typically TRL5 and above.

Value proposition to key stakeholders

The hub through its stakeholders will play a key role in realising the ambition of growing copper production to at least 1 million tonnes per annum. Stakeholders will benefit in a variety of ways, and in addition to delivering on the overall vision, the hub will have a somewhat different value proposition for each type of stakeholder group:

For current and aspiring mineral producers in South Australia: The hub will provide access to high level skills, the latest in technology trends and the opportunity to participate in the demonstration of key technologies. The hub will also provide training opportunities and high level networking. The participants will have the opportunity of influencing technology trends and development through joint participation in the Copper Development Roadmap.

For international organisations, producers and METS suppliers: an opportunity to be part of the expansion of the copper industry in South Australia and share expertise and experience for use in home jurisdictions.

For universities, CRCs and research providers: Research providers will have the opportunity to participate in the development of the Copper Development Roadmap, which will assist in providing key directions and better understanding the key needs of the mining industry. The hub will provide a very important opportunity to bring research providers, developers and users into the same room and have a common purpose.

For METS and other technology suppliers: Technology suppliers will have access to key research providers and industry partners. Through participation in the Copper Development Roadmap technology suppliers will have the opportunity to both input and influence future technology directions and trends.

For the Government of South Australia and the Australian Government: The development and application of world's leading technology practice will position South Australian industry to accelerate the development of the industry, resulting in economic growth and new jobs, while building on partnerships with Australian and international copper producers, such as in Chile.

For the broader community: An opportunity to understand and input into key hub directions, and direct engagement with other hub stakeholders.

Hub business model

It is proposed that the hub be established as a non-profit company limited by guarantee.

The mining industry is typically cyclical in nature. Technology developments in the copper mining industry can sometimes be implemented very quickly, or in some cases over a long period of time. The hub's business model should be robust and capable of sustaining and growing activities through all stages of the economic cycle. The hub should also develop a project portfolio balanced between technologies available in the short term for deployment with longer term higher risk/ higher return opportunities.

It is proposed that the hub be initially funded for a five-year period to deliver impact. Based on other collaborative models investigated, one funding model could involve support through:

Governments (Commonwealth and State), predominantly through the supply of infrastructure and establishment costs at Tonsley.

The CSIRO, through co location of resources and facilities at Tonsley.

The University of South Australia, the University of Adelaide and Flinders University, through the co-location of key personal and resources at Tonsley.

Through committed funding by a group of 'core partners' who would commit to a minimum of five years' funding, and include mining companies and technology suppliers. In return, core partners will undertake key projects within the hub and as formulated by the roadmap.

Stakeholders who are not part of the core funding will also have the opportunity to participate in activities on an ad hoc basis. An agreed commercial model will be developed to accommodate these activities.

A detailed business plan and investment prospectus will be developed as part of the hub establishment process.



Management and governance

The hub could have a small and dedicated management team focused on the successful implementation of the strategy. In addition to the CEO, a small management team will be established focusing on project management and networking skills.

It is proposed that an interim Hub Steering Committee be established to steer the hub through its formation and early development. The interim Steering Committee would review directions and priorities (as developed in the Copper Development Roadmap) and provide guidance and engagement with stakeholders.



Intellectual property

The focus of the hub will be on technology demonstration and deployment, rather than early stage research. Earlier stages of research will remain the focus of individual hub participants.

Hence as a basic principle, it is expected that the intellectual property (IP) ownership will remain in the ownership of the original participant/s, and the hub will not own any intellectual property.

Next steps

Next steps in the development of the hub include:

Forming an interim Hub Steering Committee, to drive the development of the hub's business plan and formation

Generating the Copper Development Roadmap, with participation from key stakeholders

Developing a preliminary business plan for the first five-year period

Attachment 1: Stakeholder acknowledgements

The Department of State Development acknowledges and thanks the many stakeholders who have contributed to the concept report.

Mineral Resources - CSIRO
Future Industries Institute - University of South Australia
Mineral Resource Division - Government of South Australia
Resources and Energy - Government of South Australia
South Australian Chamber of Mines and Energy
Olympic Dam Task Force - Government of South Australia
Institute for Minerals and Energy Resources - University of Adelaide
Mining Industry Participation Office – Government of South Australia
New Venture Institute - Flinders University
OZ Minerals
BHP Billiton
South Australia Chamber of Minerals and Energy
School of Computer Science, Engineering and Mathematics - Flinders University
School of Chemical and Physical Sciences - Flinders University
Deep Exploration Technologies Cooperative Research Centre
METS Ignited

Attachment 2: Collaboration models considered

Organisation	Participants	Positive features
Sustainable Minerals Institute	University and industry partners	Strong focus on environment and sustainability, community engagement. Has pilot facilities.
Catapult program	Government, industry and research partners	Significant funding by governments and companies focussing on building on UK government priority areas. High tech facilities.
Fraunhofer-Gesellschaft	Government, industry and research partners	Significant funding and coverage, with greater than 70 per cent contract research derived from industry. Significant pilot facilities.
Swerea - Mefos	Government and industry partners	Significant industry funding and pilot facilities.
Rock Tech Centre	University and industry partners	Projects fully funded by industry after development of preliminary business case. No pilot facilities.
Centre for Excellence in Mining Innovation	University and industry partners	Broad range of industry engagement. No pilot facilities.

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Published August 2016

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