Mining and Minerals Special Interest Group Climate Change Action Plan

Introduction Overall problem statement	The Mining and Minerals Special Interest Group (SIG) notes IChemE's position on climate change. The climate change action plan presented here follows on from this statement and forms part of IChemE's delivery against several of the commitments set out, namely to: ■ develop detailed positions and action plans for economically sustainable and secure transitions to net zero carbon emissions in all areas of chemical engineering practice and regions where members are active. It will also help underpin work on several other commitments to: ■ provide policy advice to governments based on chemical engineering experience and expertise; ■ engage in public outreach activities with businesses and communities, to understand their concerns about the threats and uncertainties posed by climate change; ■ develop training courses and mandate CPD to provide the knowledge and skills to support members in the transition to a net zero carbon economy and in climate change adaptation; ■ encourage all regional members groups and SIGS to hold webinars and seminars as part of the CPD programme to enhance skills and knowledge in pursuit of zero carbon futures and understanding of climate risks, as well as to engage with the wider membership.
Specific problem statement	We consider the effects of climate change, which has been well researched by international experts, could potentially have a sizeable impact on the delivery of minerals and metals to the global society. This could unfold in various ways: ■ renewable energy technologies, such as solar power, wind power, battery technologies, all require an increasing range of metals and minerals. With the expected large increase in electrification, the vast majority of these minerals and metals will come from primary mining rather than recycling; ■ the perspective around the use of important resources in achieving net zero targets needs a clear voice to enable the development of the technologies and projects needed to provide the input materials demanded;

	■ extreme climate events will affect mining operations, which are more commonly occurring in challenging environments such as in the tropics with high rainfalls and seismic conditions, arid regions like the Atacama Desert in Chile, or along the value chain such as ports or seaborne transportation; ■ the coal mining sector, particularly thermal coal, will be phased out as coal fired power stations are decommissioned and non-fossil fuel energy sources ramp up. Although more slowly, steel making will also be affected as alternative technologies that do not rely on coking coal come on-line. Steel production however could increase in demand for renewable energy infrastructure; ■ industries will transition and communities will be impacted. Resources industries traditionally support remote communities globally. The Mining and Minerals SIG has chemical engineers who are involved in all aspects of the above. Some will require re-skilling to move into new employment sectors while others will thrive in the new transition to a low carbon green energy economy. Accordingly, responses to the respective challenges of individual chemical engineers will vary greatly.
What actions need to be taken to address the issue?	We will highlight where action on climate change is critical in the mining and minerals industries and how the sector is and should be dealing with this. Within our sector, chemical engineers, whose professional obligation is to serve society, are actively completing a broad range of activities that will in various ways contribute to positive outcomes to combating climate change. These include, but are not limited to: ■ new approaches to reduce energy intensive parts of the mining and minerals value chain (eg comminution); ■ new technologies to improve renewable energy (eg lithium batteries); ■ managing renewable energy projects in the sector. Our industry deals with the consideration of large-scale endeavours and is crucial to enable, construct, and operate the minerals and materials processing infrastructure of the near future. Innovation and eventual commercialisation of novel processes at scale will be supported by the SIG.
What skills, training gap or facilitation requirements need to be addressed?	As we are heading into uncharted areas driven by human impact, we need the skills to navigate and pivot from hydrocarbon primary energy over time. This will need a range of new and emerging skills and alliances, some of which have not yet been developed. A range of actions, including training, skills and education, as well as the associated networking these activities bring, will be key to addressing the sector's gaps, and our SIG can help with this as stated below. A major concern within the sector is implications from the phase out of the fossil fuel parts of the industry, namely coal. This will require a re-purposing and transition of skills to new areas of the sector or other sectors. Planning for this needs to be underway now to ensure individual livelihoods and corporations manage this transition as smoothy as possible. As a professional body, IChemE is in an ideal position to help individual chemical engineers adapt through training programs or seek new employment opportunities for their skills through the SIG and IChemE networks. Valuing the skillsets, will home in on this portion of the resources industry and provides a steppingstone towards providing the human resources needed to address decarbonisation. An important skillset will be quantifying the impacts of climate change on process alternatives through tools such as Life Cycle Assessment to demonstrate relative benefits and footprints of the options for engineering process selection. Coupled with these skills will be the ability to communicate to

	decision makers and investors the preferred options that will balance short-term return on investment with the long-term needs to preserve our planet. The pathway to decarbonisation by many of the major mining companies has been pronounced but details on these pathways is still a work in progress. This will require lateral thinking as well as cross-sector and cross-discipline knowledge and approaches. The resources industry is frequently challenged to scale complex and high-risk innovations over short timeframes. Our SIG will look to work with the sector, and wider IChemE community, to help define these pathways. In doing so, a sector wide road map will be produced to identify different routes for achieving substantial reductions in emissions over the next 10-15 years (eg 30-40%), eventually leading to net zero emissions by 2050. By providing wide ranging opportunities for skills training, reservations and concerns that chemical engineers will be left behind without future prospects will be diminished. This is a crucial message to promote, namely that the changes in sector will create new openings and not just closedown existing industries.
What actions should the SIG and its members take to support delivery of the above actions?	Our SIG will contribute in numerous ways to address the issues facing the sector and we believe that our key role is to utilise the extensive platform of our SIG, the wider IChemE membership, and the external networks of our SIG members. These actions will include: ■ advocating and informing stakeholders on the IChemE position on climate change and then develop professional registration requirements against this position; ■ actively seek out and support those at the forefront of developing and implementing new or transitioned industries, such as innovation in distributed modular systems where replication of basic units of energy production connected through an interactive grid is prioritised over building ever larger units; ■ deliver webinars on new and emerging technologies that can positively address the sector's problems as articulated above; ■ run online forums with invited panel speakers to discuss how different parts of our global industry are tackling climate change from mitigation to adaption; ■ collaborate with other SIGs to see how combining our knowledge and experience can provide more holistic solutions to IChemE's position on climate change; ■ publish articles and present at conferences such as Chemeca, on the above content and other relevant solutions to the sector's climate change issues.
What actions will you encourage others to take?	Our SIG can work closely with other SIGs, such as water, clean energy, environment, and particle technology, to identify where there is potential for combining activities, member knowledge, and experience that could help inform and educate IChemE members. This coming together of SIGs should present new opportunities, for instance, using old mine sites for renewable energy generation or new water storage in old pits for local communities. Decarbonisation and sequestration will increasingly demand that silos created through past project types will need to be broken down. Chemicals manufacture, minerals processing, hydrocarbons processing and materials science skillsets, to name a few, will be combined in processing minerals and materials within a circular economy. There are other professional bodies, such as the Australasian Institute of Mining and Metallurgy and the Southern African Institute of Mining and Metallurgy, that will have groups and activities aligned or overlapping with our SIG action plan. Our SIG will reach out to these kindred bodies and identify how, where and

	when we can work together to provide a coordinated response. In addition, our SIG will increasingly look to connect large operators with innovators. Our SIG will also provide short 'plain English' communications (eg brochures, videos, interviews, etc) for the wider population on how the mining and minerals sector is addressing its own challenges around climate change. These will also highlight the positive contributions the sector is and will make to climate change mitigation by producing metals for the low-carbon future.
Next steps	In the next 12 months we will: ■ seek to influence the gathering of keynote discussions on the declining reliance on coal and the significance of same to the industry and new key focus areas that are generating and might continue to generate increased mining activities far into the future. By 2024, in line with IChemE strategy, we will: ■ produce a summary of the key findings from the above and develop an upskilling strategy for the benefits of the members of IChemE. Beyond 2024, we will: ■ develop and deliver critical upskilling webinars and seminars as part of CPD for the benefits of the members of IChemE; and seek to influence policy directions to aid smooth transition from fossil to renewable minerals mining. Note: Any opinions are those of the authors and do not necessarily represent those of IChemE.