IChemE Priority Topic

Responsible Production

Australian Members Groups Climate Change Action Plan

Introduction Overall problem statement	The Australian Members Groups note IChemE's position on climate change The 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, including: ■ 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 special interest groups 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, and to engage with the wider membership.
Specific problem statement	This action plan represents the five Australian Members Groups - New South Wales; Queensland; South Australia; Victoria and Western Australia, and as such has a focus from an entirely Australian perspective. Even though Australia's greenhouse gas emissions only contribute to 1% of the total global emissions, Australia has one of the highest per capita emissions at 19.2 t CO_2-e per capita in 2021 to March (Commonwealth of Australia, 2021). The biggest contributors to Australia's greenhouse gas emissions are (Commonwealth of Australia, 2021): ■ electricity accounting for 33% of Australia's total emissions in 2020; ■ industry (manufacturing, mining and oil and gas) accounting for 36% of the total emissions in 2020; ■ transport accounting for 18% of the total emissions in 2020;

- agriculture accounting for 13% to the total emissions in 2020;
- waste accounting for 2% of the total emissions in 2020;
- forestry and Land Use since 2016 forestry and land use has stored more CO_2 than has been released and has had a 119% decrease in emissions since 2005.

Recently, out of 193 countries, Australia has ranked last for action taken to reduce emissions (Sachs, Kroll, Lafortune, Fuller, & Woelm, 2021). Yet the Australian government, under the Paris Agreement, has set what it describes as an ambitious target to reduce greenhouse gas emissions by 2030 to 26-28% below the 2005 levels (Commonwealth of Australia, 2019), as part of the agreement, along with 189 other countries, to limit the increase of global temperature to 1.5°C above pre-industrial levels as well as achieving net zero emissions in the second half of this century.

Australia's economy relies heavily on the energy and resources industry which contributes to more than 60% of Australia's total emissions (Commonwealth of Australia, 2020). While many industries across Australia are actively implementing renewable energy sources into their operations and looking at ways existing assets can contribute to a clean energy future, innovation will be critical to developing new approaches and/or technologies to ensure that future low carbon sources of energy are as cost effective as coal and gas is presently. Low-cost low carbon energy sources are vital for Australia's future to balance the expectations of society for green energy without seeing major price hikes.

Australia's renewable energy sources such as wind and solar are amongst the best in the world, with more than 60,000 km^2 of available land for wind farms and average solar radiation of 58 million PJ/year however, Australia's renewable energy sources are largely underdeveloped (Commonwealth of Australia, 2014). Large industries already adopting these technologies have set ambitious targets and pathways for reduced emissions. There is significant interest from companies that are heavily reliant on energy derived from fossil fuels to decarbonise traditional heavy industries, such as iron, steel, fertiliser, mining, and cement manufacture by using renewable energy sources.[1]

As existing infrastructure is transitioned away from carbon intensive processes, looking into ways the assets can be repurposed will create new and additional value, such as pumped hydro storage, compressed air storage, and reefs for marine life for offshore oil

[1] https://www.fmgl.com.au/about-fortescue/who-we-are

https://www.santos.com/sustainability/climate-change/

https://www.australiangasnetworks.com.au/australian-hydrogen-centre

https://www.angloamerican.com/sustainability/environment/climate-change

https://www.bhp.com/sustainability/climate-change

https://www.south32.net/sustainability-approach/climate-change

	and gas pipelines and associated infrastructure. It will be important to decommission these assets in an environmentally acceptable manner. Along with reliance on the energy and resources industries in Australia, the large geographical separation between populous areas and areas of industry in Australia results in a heavy reliance on high emissions transportation to connect Australia locally and internationally. Australia's emissions from transportation from 2013-14 to 2029-30 are expected to increase by 25 per cent with the majority coming from passenger vehicles. The Australian Government has developed the National Hydrogen Strategy to assist in removing barriers and pave a way for a competitive hydrogen industry in Australia, as well as the Future Fuels Strategy to provide direction and practice actions to enable the private sector to implement low emissions road transport technologies at scale. Chemical engineers are known systems thinkers who can make core and crucial contributions to the energy transition journey. They are already actively working towards the development and implementation of cleaner fuels and can play a vital role in improving transport efficiency. Existing materials from members groups (for example, hydrogen economy webinars) provide both a strong platform for further development as well as a ready source for educating and informing the wider society. We now know, as of 2021, that the earth has already warmed by 1.1°C, with Australia having already warmed by 1.4°C (Commonwealth of Australia, 2020) Australia has a long way to go in achieving net zero emissions, however, systems thinking can make core and crucial contributions, break paradigms, and can assist industries in making changes now and setting up the processes to continually implement changes as technologies develop. Achieving net zero emissions in Australia requires either new or transferable skills and given the profession's strong track record of expanding into new sectors chemical engineers should and will play an important part. Development of CPD and training course will be key ingredients to achieving success.
What actions need to be taken to address the issue?	Our Members Groups will work with our chemical engineers to share and provide relevant content highlighting innovations and changes being made locally and internationally to reduce the environmental impact from industry and during our day to day lives. Many chemical engineers in Australia are working on creating a circular economy, as well as developing pathways to net zero emissions and doing this across a range of industrial sectors, such as world leading sustainable mining initiatives. Their knowledge and expertise would provide a valuable resource for the sharing and promoting of good practice in both Australia and globally. This would help other industries across Australia in meeting their goals and achieving their plans for continually reducing emissions moving down the pathway to becoming carbon neutral. This can also extend to enhancing the management and conservation of water and transportation emissions. Australian Members Groups are ideally placed to provide a networked platform for dissemination of this knowledge and expertise as well as providing 'safe spaces' to 'brainstorm' imaginative ideas for breakthrough initiatives. Given industry's widespread adoption of the UN Sustainable Development Goals (SDGs), the Australian Members Groups could map how Australian chemical engineers are contributing to not only SDG 13 on Climate Action but the other SDG, such as SDG 12 (responsible consumption and production) and SDG 7 (affordable clean energy) that have a material effect on mitigating the impacts of climate change.

	Outside the chemical engineering profession, Australian Members Groups could conduct outreach initiatives to engage with the wider society, such as community groups, policy makers and related business sectors. Such initiatives will help better understand how our profession can offer innovative solutions and contribute to an affordable transition for Australian society.
What skills, training gap or facilitation requirements need to be addressed?	The transition to net zero carbon emissions in all areas of chemical engineering practice and regions is a major employment challenge for Australia given the well-entrenched fossil fuel energy sector, such as coal fired power stations, oil refineries and gas infrastructure and even the more recent coal seam gas industry. This will require a concerted and resolute transformation of the workforce in these sectors, including the development of sustainable methods to continue providing the many petroleum derived products that we will continue to rely on The Australian Members Groups have strong connections with universities, many of which have had long lasting industry partnerships. These connections can be capitalised by the Members Groups to help determine the key skill sets for those chemical engineers at any stage of their career who need to transition from carbon intense energy sectors to low carbon sectors or other sectors where their skills could be applicable. For example, Australian Members Groups in collaboration with education institutions, and other professional institutions, such as, Engineers Australia, RACI, AusIMM, AIE, and more, could establish a series of courses developed with invited experts which formally recognise the transition of skillsets to different sectors eg micro-credential courses (short-term, flexible learning programs). Members groups have always been active with student and young chemical engineer competitions. Ensuring a current and future focus on competitions related to climate action, such as the recent competition in each state seeking innovative ideas for the utilisation of captured carbon, will help drive creativity and bridge the skills and knowledge gaps in these areas. In this competition, there will be four finalists ready to present their solutions by COP26; a great opportunity for a young engineer! A parallel competition could be run with Australian industry with special recognition for entities that make significant contributions to carbon abatement through either process changes or new technology commercialisation. Similar, to some of the above comments on dissemination, Members Groups have good networks to draw on speakers to present on the implications of addressing climate change and the impact this may have on our day to day lives, as well as speakers to present on current projects to reduce emissions such as Victoria's Carbon Net Project, Western Australia's CO2 injection projects, or Queensland new economy minerals (those for renewable energy technologies). Continuing this approach members groups will also seek out chemical engineers across their communities who are contributing to climate action goals and will consult with local members to harness views on moving towards a cleaner future.
What actions should the MG, its members, and others take to support delivery of the above actions?	In addition to what has been outlined above, the Australian Members Groups can work in collaboration with relevant SIGs, particularly those which have an active presence in Australia such as the Mining and Minerals SIG. In addition, Members Groups can draw on existing or partially developed training material such as on the emerging hydrogen economy mentioned at a recent Brisbane event.

Events	Our Members Groups have already been working hard to provide climate active content to its members and are continuously looking for innovations and changes being made locally and internationally to reduce the environmental impact from industry and during our day to day lives to share with their members. Upcoming and On-Demand Webinars **Past Events:** A Hydrogen Hypothesis Battery energy storage in a net zero emissions economy The Development of a Hydrogen Industry in Australia Converting Brewery Wastewater into Hydrogen Energy Liquid Metal Catalysis a New Class of Coke Resistant Catalysts Lithium – The Lifeblood of Electric Vehicle (EV) Batteries Hybrid Perovskite Quantum Dots for High Efficiency Solar Cells Chemical engineering and the circular economy in a low carbon future Hydrogen Energy Systems – Avoiding the Hype
Next steps	In the next 12 months, we will: ■ seek to present relevant events, such as webinars with recognised knowledgeable speakers and/or discussion panels, as well as resources (eg articles, short videos) to inform, help educate Australian members on chemical engineers' contribution to action on climate change; ■ begin to develop skills transition courses in collaboration with educational institutions; ■ commence the creation a chemical engineering solution-based roadmap to transition to net zero emissions in Australia; ■ run student competitions aimed at finding innovative ways to combat climate change and move toward net zero by 2050 in Australia, By 2024 in line with the IChemE strategy, we will ■ proactively engage with research facilities, industry, government reviews, consultations, and policy debates in a manner consistent with IChemE's commitment to net zero carbon emissions and the UN SDGs; ■ 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, and to engage with the wider membership; ■ engage in public outreach activities with businesses and communities, to understand their concerns about the threats and uncertainties posed by climate change.

	Beyond 2024, we will ■ continue with above activities and offer more training courses on-line and face-to-face that will help educate, reskill, and promote key carbon reduction and adaptation technologies.
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Note: Any opinions are those of the authors and do not necessarily represent those of IChemE.