CLIMATE CHANGE AND SUSTAINABILITY.

Institution of MECHANICAL ENGINEERS

Position Statement

Improving the world through engineering

imeche.org

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Executive summary

This position statement outlines the Institution of Mechanical Engineers' (IMechE) commitment to addressing climate change and promoting sustainability, in alignment with the United Nations Sustainable Development Goals (UN SDGs).

Mechanical engineers play a crucial role in solving these global issues by ensuring the integration of systems thinking, innovative technologies, and circular economy principles into their practices. Key drivers for IMechE's advocacy include the urgency of reducing greenhouse gas (GHG) emissions, addressing the rapid loss of biodiversity, and managing the growing demand for materials and energy, without compromising on environmental protection.

The statement emphasises the role of engineering professionals in creating resilient, adaptive systems that contribute to climate change mitigation, while enhancing social, economic, and environmental sustainability. IMechE's position is also grounded in a technology-neutral approach, encouraging IMechE members and the sectors within which they work to evaluate and adopt solutions that best meet global sustainability goals. Through promoting resource efficiency and circular economy practices, engineers can minimise waste, optimise energy use, and support a sustainable future.

This statement also advocates for continuous skills development, equipping engineers with the knowledge and competencies to implement these strategies. The statement outlines that IMechE will continue to drive policy, education, and industry practices that contribute to a sustainable, net zero future, empowering both its members and the broader engineering community to take meaningful action.

Our position on climate change and sustainability

Delivering a sustainable net zero energy system is one of the greatest engineering challenges faced by humanity. The Institution of Mechancial Engineers (IMechE) supports urgent action to:

- Reduce man-made emissions which contribute to global warming
- Adapt to the effects of increased heat and energy in the climate
- Design and embed sustainability at the heart of policy

IMechE supports a technology neutral, collaborative and interdisciplinary approach to policy development, which pursues and embeds new technologies, uses systems thinking to maximise impact, and is grounded in engineering evidence.

Engineers will be fundamental to delivering this policy, and IMechE believes governments will not be effective or efficient in delivering the policy without listening to the advice from the engineering community. Professional engineering institutions (PEIs) are best placed to draw on the expertise of the engineers and provide honest, impartial, expert advice to governments. Governments and PEIs must also work together to inspire the next generation of engineers, who will take over the task of designing, delivering and maintaining a net zero energy system. By doing so, society will be able to protect biodiversity, maintain and increase living standards globally, and ultimately protect the planet and its inhabitants for future generations.

IMechE's position is grounded on the following principles

Through a survey of IMechE members, results revealed that climate change and sustainability should be a policy priority for IMechE, to help provide focus to the Institution's policy work.

IMechE endorses the UN Sustainable Development Goals (SDGs) to address the mitigation, adaptation, and resilience needed with regards to climate change whilst also ensuring no one is left behind. For mechanical engineers, and those working in other professions engaged in mechanical engineering, this means that they should work proactively to minimise adverse impact, and avoid shifting it elsewhere, be it geographically, economically, environmentally or socially. Action to address climate change is a global societal priority. IMechE will work with industries and governments to support them in achieving the rate of action and change needed to meet legally binding international targets on climate change.

Adaptation and resilience

IMechE recognises the critical importance of adaptation and resilience in addressing climate change. Adaptation refers to adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects.[1] Resilience to climate change is seen as the capacity to prepare for, respond to and recover from the impacts of extreme and hazardous climatic events whilst minimising harm to the environment, the economy and societal wellbeing.[2] Engineering professionals must design and implement solutions that enhance society's ability to withstand and recover from climate impacts, while minimising environmental harm. This requires an approach that integrates social, economic, and environmental considerations, aligning with the UN's SDGs. Through innovation, collaboration, and leadership, engineers have a vital role in building adaptive, resilient systems that best ensure a sustainable future for all.

Biodiversity protection and enhancement

The Kunming-Montreal Global Biodiversity Framework has 23 action-oriented global targets for urgent action over the decade to 2030.[3] IMechE advocates for the integration of biodiversity considerations into engineering practices, ensuring that all projects and innovations contribute to the preservation and enhancement of natural ecosystems. Engineers should actively design solutions that protect species, habitats, and ecological processes, minimising environmental degradation and fostering sustainable coexistence with the natural world. Nature based solutions aim to achieve just this.[4] Through research, collaboration, and responsible decision-making, engineers have a crucial role in safeguarding biodiversity for future generations.

Global and systems thinking

To design and implement sustainable solutions to some of society's most persistent challenges whilst also acting in favour of deaccelerating the rate of climate change, a challenge that transcends borders, a global systems thinking approach is key. Assessments of lifecycles should be full and robust, including emissions and other environmental and social impacts. All should be included within appropriate standards for planning, design, construction, operation, maintenance and decommissioning. To support this, national governments should be taking responsibility for the total emissions of GHGs associated with their economies, working to implement solutions and policy to ensure legally binding international targets on climate change are met.

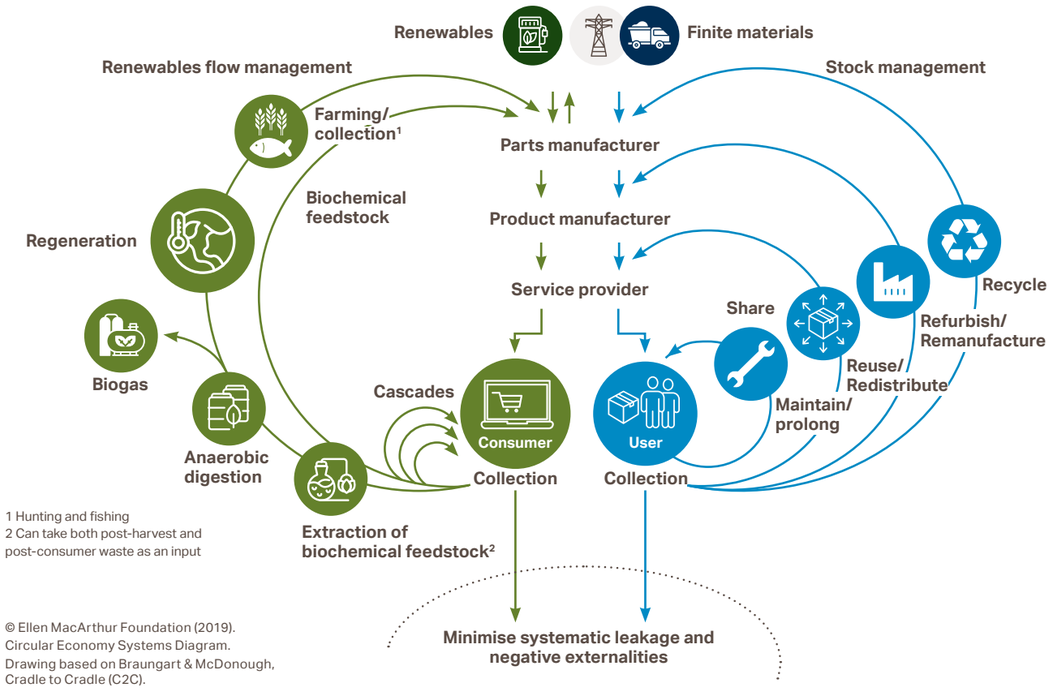
Technologically neutral

Applying the principle of systems thinking to carbon removal efforts means not advocating for specific technologies but aiming to design a whole system in the most efficient way possible. IMechE upholds this technology-neutral approach to addressing climate change and sustainability challenges. We recognise that a diverse range of technologies and innovations will be required to meet global sustainability goals. Engineers should evaluate and adopt solutions based on their effectiveness, scalability, cost, and social and environmental impact. This ensures that the most appropriate and efficient methods are applied to achieve sustainable outcomes, while fostering innovation across all sectors.

Sustainable circular economy and resource efficiency

Resource efficiency and productivity ensures the effective use of materials at every stage of their lifecycle (extraction, transportation, manufacturing, consumption, recovery, and disposal) throughout the entire supply chain.[5]

IMechE promotes the responsible use of resources across all engineering practices to minimise waste, optimise energy use, and reduce environmental impacts. Engineers should prioritise designing solutions that enhance resource efficiency throughout the lifecycle of products and systems, from material selection to manufacturing, operation, and end-of-life. By embracing circular economy principles and innovative technologies, we can reduce demand on natural resources, promote sustainability, and contribute to a net zero, resilient future.



1 Hunting and fishing
2 Can take both post-harvest and post-consumer waste as an input

Source

Ellen MacArthur Foundation

1 United Nations Climate Change. (n.d.) *Adaptation and resilience.* https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction.

2 Grantham Research Institute on Climate Change and the Environment. (2022, September 12). *What is the difference between climate change adaptation and resilience?* https://www.lse.ac.uk/granthaminstitute/explainers/what-is-the-difference-between-climate-change-adaptation-and-resilience/.

3 Convention on Biological Diversity. (n.d.) *Kunming-Montreal Global Biodiversity Framework, 2030 Targets (with Guidance Notes).* https://www.cbd.int/gbf/targets.

4 International Union for Conservation of Nature. (n.d.) *Nature-based Solutions.* https://iucn.org/our-work/nature-based-solutions.

5 OECD. (n.d.) *Resource efficiency and circular economy.* https://www.oecd.org/en/topics/resource-efficiency-and-circular-economy.html.

In a circular economy, products and materials stay in circulation through practices such as maintenance, reuse, refurbishment, remanufacturing, recycling, and composting. By decoupling economic growth from the use of finite resources, the circular economy addresses global challenges like climate change, biodiversity loss, waste, and pollution.[6]

The circular economy system diagram illustrates the continuous flow of materials in a circular economy. The diagram comprises of two main cycles, the technical and biological cycle.

In the technical cycle, products and materials stay in circulation through practices such as maintenance, reuse, repair, remanufacturing, recycling. In the biological cycle, the nutrients from biodegradable materials are returned to earth, through practices like composting, to regenerate nature.[7]

Future skills

IMechE recognises the need for continuous development of skills to address the evolving challenges of climate change and sustainability. Engineers should be equipped with the knowledge, tools, and competencies required to innovate, design, and implement sustainable solutions. By fostering interdisciplinary collaboration, embracing emerging technologies, and prioritising sustainability-focused education, we ensure that future engineers are prepared to play their role in creating a sustainable, net zero future, in line with the IPCCs definition of net zero emissions.[8] IMechE is committed to using the accreditation process to encourage higher education institutions to continue to consider how to embed sustainability and global responsibility within the taught programmes at universities and colleges.

6 Ellen Macarthur Foundation. (n.d.) *What is the meaning of a circular economy and what are the main principles?* https://www.ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview.

7 Ellen Macarthur Foundation. (2021, February 12). *The butterfly diagram: visualising the circular economy.* https://www.ellenmacarthurfoundation.org/circular-economy-diagram.

8 Matthews, J. B. R. (Ed.). (2018). Annex I: Glossary. In *Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (pp. 541-562). Cambridge University Press https://doi.org/10.1017/9781009157940.008

Guided by the United Nations Sustainable Development Goals

The UN SDGs are an urgent call for action by all countries—developed and developing—in a global partnership.[9] They recognise that the ending of poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth— all while tackling climate change and working to preserve our oceans and forests. IMechE endorses the UN SDGs.

The IMechE is concerned with all 17 SDGs, however our technical and policy work focuses primarily on SDG 3 on Good Health and Well-being, SDG 4 on Quality Education, SDG 7 on Affordable and Clean Energy, SDG 9 on Industry, Innovation and Infrastructure, SDG11 on Sustainable Cities and Communities and SDG 13 on Climate Action. However, the 17 goals are all interconnected, and the role of mechanical engineers contributes to addressing them all.

Sustainable Development Goals set by the UN

Disclaimer: The content of this publication has not been approved by the United Nations and does not reflect the views of the United Nations or its officials or Member States.

9 United Nations. (2015). The 17 Goals. https://www.un.org/sustainabledevelopment

What does the IMechE position statement mean

For IMechE

For the Institution, these principles mean an active role in driving sustainability across the engineering profession. Our Code of Conduct requires our members to engage responsibly with the environment and to balance the needs of the present with the needs for future generations.[10] IMechE must not only advocate for the integration of sustainability in engineering practices but also guide and empower its members to take meaningful action on climate change, biodiversity conservation, resource efficiency, and the circular economy. It requires fostering a culture of continuous learning and adaptation, encouraging technological innovation, and working collaboratively with industry, government, and society to meet global sustainability goals. In addition, it also requires IMechE to continue to advocate for the integration of sustainability and the UN SDGs, especially those with a climate focus, into mechanical engineering degrees, working with higher education institutions and the Engineering Council as well as governments to enable this. IMechE's role is pivotal in shaping a future where engineering not only meets the needs of today but also ensures the health of the planet for future generations.

Ways in which IMechE can make a substantive difference include:

- Providing convening leadership in the UK engineering community on power generation and distribution, critical materials, heavy industry, building systems and energy vectors to maximise the impact of this community.
- Continuing to monitor relevant courses that IMechE can provide to its members as part of their continuing professional development.
- Continuing to work alongside the Engineering Council to develop the education, skills and qualifications needed to underpin sustainable practices across engineering industries.

For IMechE members

These principles emphasise that IMechE members must be responsible stewards of the environment, actively contributing to the preservation of the environment and the reduction of GHG emissions. This position statement looks to support IMechE members achieving or fulfilling the requirements of professional registration. Within the Engineering Councils UK-SPEC, competence E, professional commitment, requires registered engineering professionals to "undertake work in a way that protects the environment and contributes to sustainable development".[11] By applying systems thinking, adopting circular economy principles and ensuring their decisions around using particular technologies are well considered, members can foster sustainable innovation and best practices. At the same time, a positive attitude towards continuous professional development and skills enhancement, which includes climate change and sustainability specific training, is essential. This will better equip engineers with the tools needed to navigate an increasingly complex and rapidly evolving industrial landscape.

These principles are not just aspirational goals but actionable steps that guide members in their everyday engineering practice. Whether designing new technologies, working on large infrastructure projects, or advocating for policy change, IMechE members have a key role to play in shaping a sustainable future.

Ways in which IMechE members can make a substantive difference include:

- Providing comprehensive, objective and balanced coverage of low carbon technology, with particular reference to their technology readiness level and the market opportunities created, drawing attention to critical topics.
- Using their expertise to advocate for sound policies and frameworks that promote sustainability and long-term environmental stewardship.
- Supporting the design and adoption of reusable, recyclable, and remanufacturable components in engineering systems to minimise waste and extend the lifecycle of materials.

For traditional sectors within which IMechE members work

For members of the IMechE working in mechanical engineering sectors, these principles mean that sustainability and climate change considerations must become a norm in their everyday work. Engineers in these sectors are expected to lead the way in minimising environmental impacts, improving resource efficiency, and adopting new technologies that help meet UN SDGs.

Each sector will need to adapt, embracing new technologies, improving processes, and designing with a longer-term, systems-based view taking into account the full environmental, social, and economic impact. Whilst for some this may require a new approach to thinking and generating solutions, it also presents an opportunity for engineers to be at the forefront of innovation in tackling some of society's most pressing challenges that are becoming more prevalent as a result of rapid climate change.

IMechE members will need to stay adaptable, develop future-focused skills, and remain committed to achieving net zero emissions and other sustainability goals. By aligning their work with these principles, members have the opportunity to be agents of change within their industries and contribute to building their sector to being more sustainable and resilient.

Ways in which traditional engineering sectors can make a substantive difference include:

- Providing opportunities for employees to engage in continuous professional development programmes and reskilling engineers working across sectors.
- Generating environmental data that can be used to record, track, and assess the environmental performance of various solutions. This data can be used internally within organisations to monitor and improve sustainability practices. Additionally, it can be leveraged for external reporting purposes, ensuring compliance with relevant reporting frameworks and regulations.
- Embracing system-based approaches, enhancing existing processes, and designing engineering solutions with a long-term perspective, considering the full environmental, social, and economic impacts.

10 Institution of Mechanical Engineers. (n.d.) *Code of Conduct Explained.* https://www.imeche.org/about-us/imeche-governance/governance-and-finance-reviews/code-of-conduct-explained.

11 Engineering Council. (2020, August). *The UK Standard for Professional engineering Competence and Commitment (UK-SPEC).* https://www.engc.org.uk/our-role-as-regulator/setting-standards/professional-engineering-competence-and-commitment.

Engineering Council: Sustainable development and the role of engineering professionals in sustainability

The Engineering Council helpfully provides guidance on sustainability for the engineering profession.[12]

The Engineering Council's definition of sustainable development:

> According to the UN-commissioned Brundtland Report in 1987, sustainable development is development that "meets the needs of the present without compromising the ability of future generations to meet their own needs"... This recognises the rights of future generations – their right to achieve a sustainable level of development and the right to be able to utilise natural resources. Sustainable development must also meet the challenge of the climate emergency by reducing energy and resource consumption to within the limits set out by science-based targets. Other crucial global challenges that require urgent action include the adverse effects of depletion of resources, environmental pollution, increased consumption, and damage to ecosystems including loss of biodiversity.

The role of engineering professionals in sustainability:

> Engineering professionals have a significant role to play in helping society achieve a more sustainable way of living. They work to enhance the welfare, health and safety of all, paying due regard to the environment and the sustainability of resources. Their work is influenced by the opportunities and challenges that sustainability brings. Due to their knowledge and skills, they are the providers of options and solutions to maximise social value and minimise environmental impact. Engineering professionals carry out their role in a broad context, encompassing social, ethical, environmental and economic challenges. Increasingly those working in engineering are required to take a wider perspective including the goals set out in the UN's Sustainable Development Goals. Globalisation brings important opportunities for engineering professionals to promote change through sharing experience and good practice. They have a key leadership and influencing role in working towards sustainability, increasingly as part of multi-disciplinary teams that include non-engineers, and through work that crosses national boundaries.

12 Engineering Council. (2021). *Guidance on sustainability for the engineering profession.* https://www.engc.org.uk/resources-and-guidance/guidance-for-the-profession/sustainability.

IMechE strive to keep information up to date and welcomes feedback from members.

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