

Presidential Inquiry

Engineering Tomorrow: The Five Forces Shaping Chemical Engineering – Terms of Reference

1. Purpose

Chemical engineering is central to modern life. It underpins energy systems, clean water, medicines, food and drink, advanced manufacturing, materials and many of the technologies required for a more sustainable and resilient economy. Yet the profession is itself being reshaped by rapid technological, environmental, industrial and societal change.

The IChemE Presidential Inquiry, Engineering Tomorrow: The Five Forces Shaping Chemical Engineering, will examine how chemical engineering can respond to, enable and lead that change.

Building on Professor Raffaella Ocone's Presidential Inquiry into chemical engineering research, this Inquiry will look beyond the current state of the discipline towards its future direction, relevance and public value.

It will be forward-looking, practical and ambitious. Its starting point is not that chemical engineering is a profession under threat, but that chemical engineers have an essential role to play in addressing some of the defining challenges and opportunities of the coming decade.

2. Core Inquiry question

How should chemical engineering adapt to, enable and lead the five forces reshaping industry, society and the economy?

3. The Five Forces

The inquiry will be guided around five pre-identified forces:

1. Artificial intelligence and machine learning

How AI, machine learning, data and digital technologies are changing process design, optimisation, control, safety, research and engineering decision-making, and the skills and professional standards required to use them effectively and responsibly.

2. Decarbonisation, climate adaptation and resilience

How chemical engineers can contribute to industrial decarbonisation while also designing processes, infrastructure and supply chains capable of operating in a changing and less predictable climate. The Inquiry will consider both mitigation and adaptation, including industrial resilience, resource and water constraints, changing environmental conditions and the need to develop safe, economically viable solutions at scale.

3. Materials revolution and the circular economy

How chemical engineering can enable the transition from linear models of production and consumption towards more circular systems through new and lower-impact materials, advanced recycling, separation and recovery technologies, whole-lifecycle design and scalable manufacturing.

4. Bio-integration

How the increasing convergence of chemical engineering, biotechnology and engineering biology is creating new approaches to chemicals, pharmaceuticals, fuels, food and materials, and what this means for education, skills, industrial practice and scale-up.

5. Modular manufacturing

How smaller, standardised, flexible and potentially localised production systems may change the geography and economics of manufacturing, supply-chain resilience, investment models, regulation, process safety and the skills required of chemical engineers.

These forces will not be considered in isolation. The Inquiry will examine their interaction and, in particular, the role of chemical engineering as an integrating discipline capable of translating scientific and technological innovation into safe, practical, scalable and economically viable solutions.

4. Cross-cutting themes

Skills and the future workforce: The capabilities future chemical engineers will require and whether education, accreditation, continuing professional development and employer training are keeping pace with change. This will include how experienced professionals in established sectors can transfer their knowledge and skills into new and emerging industries.

Pathways into the profession: How apprenticeships, technician routes, non-traditional pathways, career changers and different educational backgrounds can contribute to a resilient future workforce.

Scale-up and deployment: How chemical engineering can continue to bridge the gap between scientific discovery or technological innovation and safe, economically viable deployment at industrial scale.

Process Safety: Implementing chemical engineering in a world shaped by the new forces will introduce new risks that industry codes and standards and our most effective tools are not yet equipped to fully mitigate. The will present new development opportunities in the field of process safety.

Public understanding and trust: How the profession can better explain its contribution to policymakers, industry, educators, young people and the wider public.

International perspectives: Recognising IChemE's international membership and the different industrial, environmental, economic and societal circumstances in which chemical engineers operate. The Inquiry will actively seek evidence and examples from the UK and internationally, including Australia and Malaysia.

5. Approach

The Inquiry will draw evidence from practising chemical engineers, industry and employers, academia and education, early-career professionals and students, policymakers, regulators and other relevant organisations and disciplines.

It will seek a deliberate balance between academic and industry/practitioner evidence. In addition to an open Call for Evidence, IChemE will undertake targeted engagement with employers, practising engineers

and relevant industrial sectors to ensure that the Inquiry reflects experience from those applying chemical engineering in practice.

Evidence may be gathered through:

- a public Call for Evidence;
- targeted written submissions;
- industry and expert roundtables;
- interviews and evidence sessions;
- engagement with IChemE members and technical communities;
- international engagement and case studies.

The Inquiry will deliberately seek challenging, novel and unexpected perspectives, rather than simply seeking consensus or validation of current practice. One measure of its success will be whether it identifies significant opportunities, challenges or developments not anticipated at the outset.

The Inquiry will aim to provide practical and evidenced recommendations that are actionable by the target organisations. In doing so, it will attempt to be concise and direct rather than performing an exhaustive review of all related issues and subjects.

6. Outputs

The Inquiry will aim to produce:

- a concise and accessible Presidential Inquiry report;
- practical recommendations for IChemE, industry, employers, educators and policymakers;
- an evidence base and case studies demonstrating how the Five Forces are already changing chemical engineering internationally;
- public-facing material explaining the changing role and contribution of chemical engineering;
- briefing material for policymakers and industry; and

7. Timeline

The inquiry launches on Tuesday 29 September 2026 with an initial call for evidence. Submissions close at the end of November. From January to March 2027, the team will gather further evidence through interviews and workshops, supported by ongoing desktop research. The final report—detailing findings and recommendations—will launch in early May 2027. Look out for interim summaries and updates throughout the process.