

SUSTAINABILITY AND THE CHEMISTRY ENTERPRISE

A sustainable society is one that meets the needs of today's population without jeopardizing the ability of future generations to thrive. The United Nation's 17 Sustainable Development Goals illustrate the complexities inherent in addressing the challenges to achieving a sustainable society, which aim to meet the fundamental needs of all people and preserve the health of the planet. Slowing and reversing environmental degradation will require fundamental changes in the global economy. Failure to embrace significant change will only exacerbate the current crisis, increasing competition for ultimately finite resources. The convergence of basic and applied research to understand the integrated nature of society and the natural world can address these challenges. An inter-disciplinary systems-level approach across academia, industry, government and NGOs will be essential to understanding how human activities impact the Earth, and how our limited resources can be best utilized to sustain society.

Role of Chemistry in Sustainability

Chemists and chemical engineers have the dual roles of making materials from life's building blocks *and* understanding the impact these actions have on the environment. As stated in a recent report from the National Academies, "while chemistry has enabled quality-of-life advances, many of these advances have had unforeseen negative consequences. Therefore, chemistry is both the source of many current global problems and will enable the potential solutions to these problems".¹ As chemists, it is imperative to design and implement economically and socially viable products and processes to minimize resource depletion and impact on the environment.

Chemistry plays a central role in society through its researchers, producers, and educators. As researchers, the chemistry enterprise seeks to discover new knowledge to help chemistry and society meet various challenges related to sustainability. As producers, the chemistry enterprise uses materials provided by supply chains, as well as processes developed through research to provide materials to meet societal needs. Chemical production also requires an awareness of waste considerations and the need for circularity. As educators, the chemistry enterprise seeks to cultivate the necessary knowledge, skills and ethical awareness in the next generation of diverse scientists required for inclusive global sustainable development. In all of these positions, environmental equity and environmental justice must be an integral part of the decision-making process, and include input from a diverse set of voices.

ACS Recommendations

Regulation and Engagement

Government can amplify the beneficial impacts of the knowledge, technology, and human capital advanced by the chemistry enterprise through lawmaking, regulatory processes, international agreements, and communication with the public.

To this end, the U.S. Government Should:

- Enact and enforce policies and standards to preserve the environment, boost efficiency, and protect public health. Such practices and standards include:

¹ "The Importance of Chemical Research to the U.S. Economy." 2022. National Academies of Sciences, Engineering, and Medicine.

- reducing greenhouse gas (GHG) emissions (see the ACS statements on Energy Policy and Climate Change) to slow and reverse climate change;
 - protecting our air, water, and land from pollutants detrimental to human and environmental health, including robust enforcement of landmark environmental laws such as the Toxic Substances Control Act, the Clean Air Act, and the Clean Water Act;
 - reducing waste, incentivizing circularity, and ensuring that technology transfers incorporate health and safety concerns;
 - promoting sustainable energy development and use;
 - promoting environmental equity and environmental justice in every step of the decision-making process.
- Use best available science from trustworthy, unbiased and peer-reviewed sources to inform environmental, energy, industrial and public health policy-making (see the ACS statement on Scientific Integrity and Insight).
 - Encourage and facilitate the development and use of sustainability metrics for long-term adoption by private enterprise and federal agencies alike. These include environmental and toxicological impact assessments, energy consumption, and greenhouse gas and pollutant emissions.
 - Join and lead international coalitions to ratify critical treaties and agreements concerning sustainability and the environment (e.g. the Paris Climate Agreement, the Kigali Amendment to the Montreal Protocol, and the Stockholm Convention on Persistent Organic Pollutants).
 - Continue to pass legislation that encourages sustainable products and the use of circular processes, through various economic incentives.
 - Encourage and expand government procurement programs such as Safer Choice and BioPreferred which mandate government spending on purchasing of alternative greener products.

Research, Development, and Deployment

Meeting human needs globally now and in the future will require new knowledge, novel technologies, and transformative collaborations. The federal government can support the chemistry enterprise's role through: funding research, development, and demonstration; developing an informed workforce; and facilitating communication and collaboration between stakeholders and with the public.

To this end, the U.S. Government Should:

- *Mobilize the interagency working group on sustainable chemistry to assess the state of research and development for the field on a regular basis. Additionally, the working group should coordinate and increase federal support for green and sustainable chemistry.*
- Encourage and incentivize conservation and substitution of critical raw materials (see ACS Critical Materials Statements), reuse and recycling of post-consumer materials in new products, and the reduction of single-use, waste-generating materials such as plastics.
- Incorporate the potential to advance green and sustainable science into proposal review criteria for relevant programs. Issue research solicitations requiring convergence across disciplines. Fund research that both advances scientific knowledge and contributes to addressing sustainability challenges.
- Facilitate the scaling up and industrial application of nascent sustainable processes and technologies by expanding public-private partnerships and assisting the translation of ideas from the laboratory into the marketplace.
- Support initiatives seeking to foster a culture of sustainability, both in educating the next generation of chemists and chemical engineers, and in the current workforce.
- Continue and promote the prestige of award programs and competitions that

incentivize innovations, drive creativity, and share best practices to advance the sustainability of the production of molecules and materials, such as the Green Chemistry Challenge Awards.