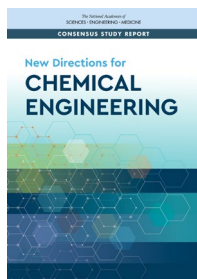


# Chemistry 2050: A Roadmap to the Future

## *Pre-Reading Materials*

Summarized below are recent National Academies reports relevant to topics that will be addressed in this workshop, and can be used to prepare for the workshop discussions.

### Visions for Chemistry and Chemical Engineering



[New Directions for Chemical Engineering \(2022\)](#) This consensus report describes major advances and changes in chemical engineering over the past three decades and provides guidance about challenges and opportunities facing chemical engineering over the next 10–30 years. The report focuses on the following topic areas: energy and the energy transition; water, food, and air; health and medicine; manufacturing and the circular economy; and materials. It also considers tools and techniques that can yield advances across topic areas, and innovations needed in chemical engineering education.

- [Report highlights document](#)



[The Importance of Chemical Research to the U.S. Economy \(2022\)](#) This consensus report examines the evolving chemistry landscape and identifies strategies and options for research investments that will support U.S. leadership while considering environmental sustainability and developing a robust chemical economy workforce.

- [Report highlights document](#)

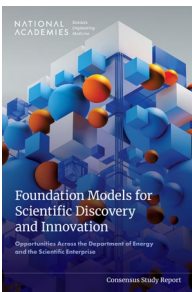


[Innovations in Catalysis to Address Modern Challenges: Proceedings of a Workshop—In Brief \(2023\)](#) This report summarizes an October 2022 workshop of the Chemical Sciences Roundtable that discussed how the chemistry and chemical engineering communities can contribute practical solutions for improving chemical production through catalysis.



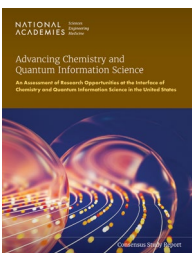
[Advances, Challenges, and Long-Term Opportunities in Electrochemistry: Addressing Societal Needs: Proceedings of a Workshop—In Brief \(2020\)](#) This report summarizes a November 2019 workshop of the Chemical Sciences Roundtable that explored emerging applications of electrochemistry and discussed the future of the field.

## Quantum Computing and Molecular Discovery



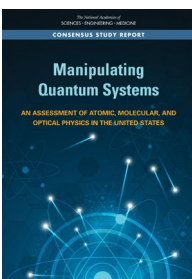
[Foundation Models for Scientific Discovery and Innovation: Opportunities Across the Department of Energy and the Scientific Enterprise \(2025\)](#) This consensus report explores how foundation models can complement traditional computational methods to advance scientific discovery, highlights successful use cases, and recommends strategic approaches and investments to support the Department of Energy's mission.

- [Report highlights document](#)



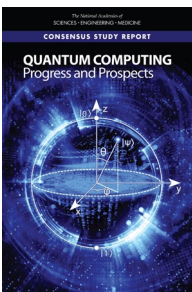
[Advancing Chemistry and Quantum Information Science: An Assessment of Research Opportunities at the Interface of Chemistry and Quantum Information Science in the United States \(2023\)](#) This consensus report examines opportunities at the interface of chemistry and quantum information science (QIS), providing recommendations on research and other needs to facilitate progress. The report identifies the following priority research areas to advance the field of QIS and chemistry: design and synthesis of molecular qubit systems; measurement and control of molecular quantum systems; and experimental and computational approaches for scaling qubit design and function.

- [Report highlights document](#)



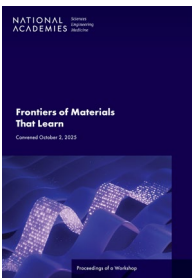
[Manipulating Quantum Systems: An Assessment of Atomic, Molecular, and Optical Physics in the United States \(2020\)](#) This consensus report assesses opportunities in atomic, molecular, and optical science and technology over the next decade, with key topics including tools made of light; emerging phenomena from few- to many-body systems; foundations of quantum information science and technologies' quantum dynamics in time and frequency domains; precision and the nature of the universe, and the broader impact of atomic, molecular, and optical science.

- [Report highlights document](#)



[Quantum Computing: Progress and Prospects \(2019\)](#) This consensus study assesses the feasibility and implications of creating a functional quantum computer capable of addressing real-world problems. It considers hardware and software requirements, quantum algorithms, drivers of advances in quantum computing and quantum devices, benchmarks associated with relevant use cases, the time and resources required, and how to assess the probability of success.

## Materials Science and Manufacturing

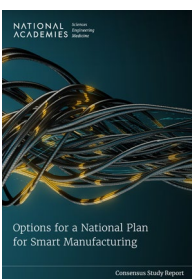


[Frontiers of Materials That Learn: Proceedings of a Workshop \(2026\)](#) This report summarizes an October 2025 workshop that convened researchers from materials design, condensed matter physics, biomaterials, and industry to discuss new opportunities for materials that learn and ways to move toward the scalable design and manufacturing of these learning systems.



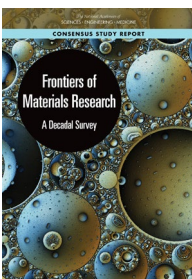
[A Vision for the Manufacturing USA Program in 2030 and 2035 \(2026\)](#) This consensus report examines how the Manufacturing USA program can be strengthened to meet the nation's manufacturing challenges over the next decade and beyond. The report makes recommendations around technology transfer, interagency and cross-network collaboration, regional manufacturing ecosystems, and education and workforce development.

- [Report highlights document](#)

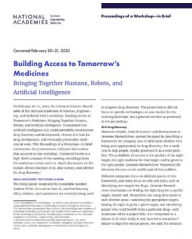


[Options for a National Plan for Smart Manufacturing \(2024\)](#) This consensus report examines promising technologies transforming the manufacturing sector and identifies the research and resources needed to accelerate smart manufacturing adoption industry wide. The report also identifies critical needs for education and workforce development for smart manufacturing and recommends actions to support and train the next-generation manufacturing workforce.

- [Report highlights document](#)



[Frontiers of Materials Research: A Decadal Survey \(2019\)](#) This consensus report documents the status and future directions of materials research in the United States and globally. It reviews progress over the past decade, identifies research opportunities for 2020–2030, and considers impacts that materials research has had and will have on emerging technologies, national needs, and science.

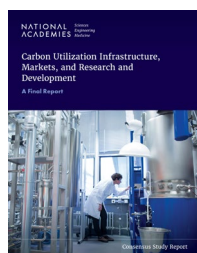


[Building Access to Tomorrow's Medicines: Bringing Together Humans, Robots, and Artificial Intelligence: Proceedings of a Workshop—in Brief \(2025\)](#) This report summarizes a February, 2025 workshop of the Chemical Sciences Roundtable that examined how artificial intelligence (AI) could potentially revolutionize drug discovery and development, shorten the time for drug development, and eventually personalize medicine at scale.

## Carbon Feedstocks and the Circular Chemical Economy

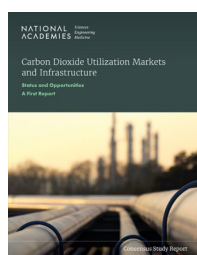


[Circularity and Plastics: Proceedings of a Workshop \(2025\)](#) This report summarizes a May 2025 workshop that explored circularity and other approaches for sustainable life cycle management of plastic materials.



[Carbon Dioxide Utilization Infrastructure, Markets, and Research and Development: A Final Report \(2024\)](#) This consensus report identifies potential markets and commercialization opportunities for CO<sub>2</sub>- and coal waste-derived products; examines economic and environmental impacts of CO<sub>2</sub> utilization infrastructure; and puts forward a comprehensive research agenda for carbon utilization technologies.

- [Report highlights document](#)



[Carbon Dioxide Utilization Markets and Infrastructure: Status and Opportunities—A First Report \(2023\)](#) This consensus report assesses the state of the infrastructure for CO<sub>2</sub> transportation, use, and storage, and identifies key opportunities to improve and expand on that infrastructure to enable future CO<sub>2</sub> utilization development.

- [Report highlights document](#)