

Elements of a Roadmap to Transition the Chemical Industry Toward Sustainable Chemicals and Materials

Joel A. Tickner, ScD

Sustainable Chemistry Catalyst, University of Massachusetts Lowell

The chemical industry is at a crossroads. While the industry is critical for achieving sustainable development and a high quality of life, it is also a primary contributor to the climate, toxic pollution, and plastic waste crises that now threaten human and planetary health. Its reliance on fossil fuel feedstocks and a small number of platform chemicals, rigid manufacturing processes, massive economies of scale, and depressed innovation is not sustainable. Global action on climate change and materials circularity combined with the post-pandemic economic response are resulting in unprecedented capital investments and provides a unique moment to transition the industry to a new, sustainable paradigm. We argue that a transition roadmap – beyond simply a fossil carbon transition - should be developed for the chemical industry, requiring changes in energy, feedstocks, molecules, processes, and products. We outline principles, strategies, and implementation actions that will be required in an industry reinvention. Achieving an industry transition of the magnitude required will necessitate a “wartime effort” equal to those efforts that launched the petrochemical industry in the 1940s and led to its rapid postwar growth. It must involve both incremental and leapfrog changes, not just to the industry itself but to the production and consumption systems connected to it. And it will require the mobilization and coordination of governments, financial institutions, businesses across the value chain, and civil society. We are hopeful yet confident that given the right conditions, resources, leadership, and commitment, a new chemical industry will flourish as did its forebearer, but sustainably and with far less negative impact.