CONGRESS

TSCA

Green Chemistry is part of the ongoing negotiations between the House and Senate as they consider reforms to the 1976 Toxic Substances Control Act (TSCA). Joel Tickner explores why research, development, education and supply chains anchored in green chemistry will help achieve sustainability. This is the second in a three-part series on negotiations to reform TSCA.

Mainstreaming Green Chemistry: Why TSCA Reform is Necessary but Not Sufficient

BY JOEL TICKNER, UMASS LOWELL

During the past 10 years there has been significant growth in regulatory and market demands for safer chemicals and more sustainable products. Reforming our toxics laws may go some distance towards incentivizing safer compounds but it will not be enough.

In the absence of federal policy leadership, a number of states have enacted laws restricting particular priority chemicals and requiring disclosure of chemicals of concern in children's products. The state of California is moving forward with its Safer Consumer Products regulations, which will require companies to evaluate alternatives to chemicals of concern in priority products. And the European Commission has, for the past several years, been implementing its Registration, Evaluation and Authorization of Chemicals (REACH) regulation, in particular the law's sections on restrictions and authorization of Substances of Very High Concern. Meanwhile, consumer advocacy campaigns have successfully engaged major brands and retailers to demand greater chemical transparency in their supply chains and to restrict specific chemicals of concern in their manufacturing and sourcing.

Despite these increasing demands for safer chemicals, the supply of green chemistry solutions has not grown at the same scale. This is in part because the focus of most market and policy efforts to date have been on ''avoiding bads'' rather than promoting innovation.

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Public policy research clearly shows the important role of regulation in spurring innovation. But that same literature indicates that effective innovation policy requires attention not only to ''willingness'' (often driven by regulation) but also ''capacity'' (knowledge and support to innovate, such as education and technical support) and ''opportunity'' (incentives for innovation, such as tax and investment credit). It is in these latter two—focused on the supply of green chemistry solutions—that green chemistry policy to date has fallen short.

While green chemistry, research, education and adoption have certainly occurred and there are an increasing number of green chemistry success stories, it is still a niche consideration. Green chemistry has yet to be integrated into the fabric of the chemical enterprise, educational systems, or government programs. For example, it has received little attention or support from the White House or agencies outside of the Environmental Protection Agency and the National Science Foundation, which have only small and underresourced green chemistry programs. A recent EPA Inspector General report noted that the EPA Office of Chemical Safety and Pollution Prevention budget for green chemistry is less than $100,000. While the EPA has elevated and invested in some market-based programs to support safer chemicals, such as its Safer Choice program, these are still relatively small compared with traditional risk assessment efforts. We have tended to focus significantly more resources on studying and acting on problems than on designing innovative, scalable solutions—a win-win for everyone.

The Green Chemistry & Commerce Council (GC3), a multi-sectoral, business-to-business forum that works collaboratively to accelerate the application of green chemistry across industry sectors and supply chains, has spent the past two years exploring barriers to green chemistry and ways to accelerate its adoption. Our research has identified a number of barriers to green chemistry, including: (1) the complexity of global supply chains and their established infrastructures, (2) the costs and time to scale and adopt new technologies, (3) the incumbency of existing technologies that are cost-effective and high performing (but may be problematic

environmentally), (4) concerns about the risks involved in moving to green chemistry solutions (performance, process changes, material incompatibility or costs of recertification and potential for substitutes to be later designated chemicals of concern) and (5) limited investment, incentives, education and metrics for green chemistry. Even when viable green chemistry solutions exist, they may not be taken up in the marketplace as a result of some of these barriers.

However, a report by the sustainability research firm Trucost entitled *Making the Business Case for Safer Chemistry*, commissioned by the GC3 and the American Sustainable Business Council, identified a number of risks that companies take by not adopting green chemistry solutions. These include the risk of NGO and/or shareholder activism, regulatory risks, costs of incidents and accidents from hazardous materials, product liability and lost market opportunities. Conversely, companies that pursue safer chemistry can have higher growth rates than conventional markets, increased capital flows, greater market opportunities and job growth. A number of other studies have shown the potential for job growth, reduced costs, new markets and lower handling and disposal costs.

Given the clear business case for green chemistry innovation, and very obvious barriers to its adoption, the GC3 developed its Agenda to Mainstream Green Chemistry to focus on concrete strategies and actions that can be taken in the coming years to accelerate green chemistry research, development, and adoption. The agenda was developed based on more than two years of research and stakeholder dialogue and identifies five broad strategies to accelerate green chemistry innovation, including:

- *Enhance Market Dynamics.* Building a comprehensive, ongoing understanding of green chemistry enablers, market drivers and obstacles allowing for more effective interventions that create market shifts to support green chemistry research, development and adoption.
- *Support Smart Policies.* Designing and advocating for innovative state and federal policies that can effectively support the supply of and demand for green chemistry solutions.
- *Foster Collaboration.* Facilitating the flow of information about green chemistry solutions among suppliers and product makers as well as assembling partnerships to tackle priority challenges can support the collaborations necessary to grow the marketplace for green chemistry solutions.
- *Inform the Marketplace.* Disseminating information about green chemistry business, economic and health benefits, as well as opportunities and funding creates a clearer business and economic case for green chemistry.
- *Track Progress.* Improving green chemistry metrics and periodically gathering and reporting data on progress provides a way to demonstrate benefits and understand where interventions are necessary to accelerate green chemistry.

There is a critical and necessary role for government leadership and government funding in accelerating green chemistry as it has for the renewable energy and nanotechnology sectors. But this requires a more coordinated federal approach.

As such, the GC3 has strongly supported the Sustainable Chemistry Research and Development Act of 2015, introduced by Sen. Chris Coons (D-Del.). Language from the bill has also been introduced (as Section 24) into the recently passed Frank R. Lautenberg Chemical Safety for the 21st Century Act. There are a number of government actions included in the bill that have been identified as priorities for GC3 members, including:

- Development of a coordinated national green chemistry strategy,
- Establishment of sustained support (policy, organizational, technical) for green chemistry research, development, technology transfer, commercialization, education and training,
- Collection and dissemination of information and research on barriers and green chemistry solutions,
- Support and facilitation of supply chain and academic-industry partnerships,
- Providing incentives (and climate) for green chemistry R&D and manufacturing, and
- Providing ways to measure costs/benefits and progress towards green chemistry.

While important, Sen. Coons's bill is necessary but does not go far enough. It has to be coupled with adequate funding for agencies to implement the programs, combined with the establishment of sustained public and private sector funding to target critical green chemistry needs.

Reform of the Toxic Substances Control Act can be supportive of green chemistry innovation by providing important information on chemical uses, toxicity and exposures and regulating those chemicals of highest concern, providing a demand signal for green chemistry solutions. Clear demand signals are not enough if they are not coupled with a sufficient supply of innovative, cost-effective and high-performing alternatives that are taken up in the marketplace. Demand side policies must be accompanied by government and market policies to change chemistry research, education, investment, commercialization and scale that can effect a shift in the chemicals enterprise necessary to mainstream green chemistry.

Effecting such a shift in the chemicals enterprise will require ensuring a new generation of chemists, engineers and toxicology experts are knowledgeable about green chemistry. GC3 companies recognized this in developing the GC3 Policy Statement on Green Chemistry in Education, including a training curriculum for supply chains. At this point, most engineers and chemists are not taught to think about how chemical and process design can affect health and environment. They are not taught tools of toxicology or lifecycle design. Similarly, most toxicologists and public health professionals are not taught about innovation and or chemicals and process design. A number of efforts are underway by the American Chemical Society's Green Chemistry Institute, the non-profit Beyond Benign, and others to increase green chemistry education at the K-12 and university level. However, these interdisciplinary education efforts will need to be scaled in the future if green

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chemistry is to be integrated into the fabric and culture of education and ultimately business.

Policies that combine the three elements of innovation exist. As an example, for the past 30 years Massachusetts has made significant strides in reducing the use of the use of toxics in manufacturing (such as a 95 percent reduction in the use of trichloroethylene) through its innovative Toxics Use Reduction Act. That law requires manufacturers to report on their chemical use every year and conduct a plan of how they will reduce their use of toxic chemicals and waste generation every two years. The regulatory requirements are supplemented by a government and academic research institute program (funded by regulatory fees) that supports training, research, demonstration projects, technical assistance and evaluation of safer substitutes.

This a unique time to accelerate the growth of green chemistry. Over the past decade, concerns about public and environmental health have increased and consumer and policy demand for safer products has grown. This has led to unprecedented growth in collaborations between sectors and within supply chains to advance safer, more sustainable chemicals and products. We have an opportunity to position the United States as a global leader in sustainable chemistry. But this will need a vision, leadership, resources and collaboration. No one policy will be sufficient to drive green chemistry. A package of ''smart policies'' that create not only demands but also the incentives and infrastructure necessary to scale green chemistry innovation will be needed. The GC3 looks forward to working with government, industry, academic groups and others in making this vision a reality.