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## Less energy-intensive alternative separations: creating a roadmap to accelerate industrial adoption

**KEYWORDS:** Energy efficiency, industrial roundtable, Green Engineering.

**Abstract** Separation processes account for over 35% of energy used in chemical manufacturing. To advance the availability of less energy-intensive separations for industrial adoption, the Chemical Manufacturers Roundtable at the ACS Green Chemistry Institute® in partnership with AIChE sought a NIST AMTech planning grant to collaboratively create an innovation roadmap. Since receiving the award in May 2015, the collaboration has expanded to include researchers from universities and national labs, suppliers of commercial separations equipment, and a growing list of interested manufacturers and sustainability leaders. Successful roadmap development depends on the involvement of a wide range of chemical science and engineering innovators.

Separating mixtures into valuable components is central to chemical manufacturing. Distillation is the approach generally used to effect these separations because it is a dependable, well-understood method that works. The problem is that distillation is a very energy intensive operation. Over 35% of total energy use in U.S. chemical manufacturing is consumed by distillation (1).

At a time when chemical manufacturers are focused on cutting energy use to reduce costs and greenhouse gas emissions, a key challenge for the sector is transforming the energy efficiency of separation processes. Volatile energy prices and the high capital investment required for conventional separations equipment present an opportunity for change.

Manufacturers need effective and less energy-intensive alternative separation technologies that are appropriate for specific industrial separation tasks and that have demonstrated performance and available design tools for predictable scale-up. To achieve this, a diverse and inclusive group of stakeholders must come together and

### Collaborators include:

ACS GCI Chemical Manufacturers Roundtable (Ajinomoto North America, Inc., Albemarle, Arizona Chemical, Chemours, Dixie Chemical, DuPont, Pen A Kem, Sigma-Aldrich, and Solvay USA Inc.)

American Institute of Chemical Engineers (AIChE) (including its Institute for Sustainability, Separations Division, and Computational Molecular Simulation & Engineering Forum)

NIST Materials Measurement Laboratory

Industrial Fluid Properties Simulation Collective

Pine Chemicals Association

AstraZeneca, GlaxoSmithKline, Merck, Sanofi

Ingevity, Compact Membrane Systems, University of Toledo, Rowan University

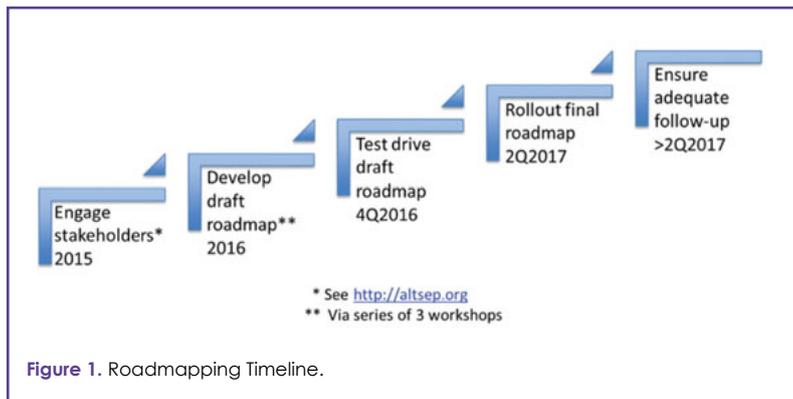
meet this 21st century challenge head-on.

### ALTSEP

With use of distillation in common and with reducing the energy consumption in chemical manufacturing as a shared aim, the Chemical Manufacturers Roundtable at the American Chemistry Society Green Chemistry Institute (ACS GCI) began a pre-competitive joint effort in 2013 to investigate less energy-intensive alternative separation (ALTSEP) technologies (2). The Roundtable sought processes that could competitively displace distillation when new or replacement equipment is being specified. This collaboration provided the basis for a proposal to the U.S. National Institute of Standards and Technology (NIST) Advanced Manufacturing Technology (AMTech) program for a highly competitive planning grant.

Awarded in May 2015, the two-year NIST AMTech planning project

is aimed at creating an innovation roadmap for advancing the rational design and predictable, widespread industrial



application of less energy-intensive separation processes as alternatives to distillation (Figure 1). The roadmap will identify and prioritize research, development, and demonstration needs for technology initiatives with the potential to transform the competitiveness and sustainability of the chemical industry. Successful development of the roadmap depends on a collaborative effort among innovators from chemical and pharmaceutical manufacturers, universities, research institutions, and professional organizations such as ACS and AIChE. The ultimate aim of this effort is to establish and maintain

a robust ecosystem across the chemistry enterprise that enables industrial implementation of less energy-intensive alternative separations technologies.

In order to achieve these goals, the ACS GCI Chemical Manufacturers Roundtable would like you to get involved and contribute. We are soliciting input from companies in the chemical and allied manufacturing sector on the types of separations currently performed via distillation so that we can assure roadmapping stays in tune with industrial needs.

Please contact [gciroundtables@acs.org](mailto:gciroundtables@acs.org) with your input. To learn more and to get involved, please visit

<http://altsep.org>.

#### REFERENCES

1. NRC. *Sustainability in the Chemical Industry: Grand Challenges and Research Needs - A Workshop Report*; The National Academies Press: Washington, D.C., 2005.
2. Giraud, R.J., Williams, P.A., Sehgal, A., et al. Implementing Green Chemistry in Chemical Manufacturing: A Survey Report. *ACS Sustainable Chemistry & Engineering* 2014, 2, 2237-2242.

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