

Rethinking Cellulosic Ethanol (and Other Cellulosic Biofuels)

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Abstract

In October 2017, Beta Renewable's Crescentino, Italy cellulosic ethanol plant announced its closure. Shortly thereafter Dow-DuPont exited the cellulosic ethanol business. BP, Abengoa and many other companies left this field years earlier.

It seems time to rethink our efforts to commercialize cellulosic ethanol—and for that matter, all cellulosic biofuels. What are the remaining barriers? Difficulties with the enzymes and fermentation organisms have not been cited as the key technical problem(s). The companies that have abandoned cellulosic ethanol cite complex biomass supply chains and continuing difficulties with the pretreatment step as key reasons for leaving the business.

Because of recent low oil prices, global investment in oil discovery and the discovery of new oil fields have collapsed. Given rising demand, and declining oil production, another major oil price spike is likely in the next few years. Global interest in cellulosic biofuels will probably reignite. How will we respond?

The remaining barriers for cellulosic ethanol are probably less in the biorefinery than in the upstream operations of biomass handling, storage, transport and preprocessing. Pretreatment at scale remains an unsolved problem. There are also crucial supply chain questions: who will grow the biomass, where, when, how and especially why? We must think realistically about how farmers can participate in and benefit from cellulosic biofuels and adapt ourselves accordingly.

We need to address the real, remaining challenges with cellulosic ethanol, and other liquid cellulosic biofuels, or risk irrelevance as a research community.

Brief CV

Dr. Bruce E. Dale received his bachelor's (*summa cum laude*) and master's degrees in chemical engineering from the University of Arizona and the doctorate from Purdue University in 1979. Dr. Dale is currently University Distinguished Professor of Chemical Engineering at Michigan State University. He serves as Editor in Chief and Founding Editor of the journal *Biofuels, Bioproducts and Biorefining*. He won the

Charles D. Scott Award (1996) for contributions to biofuel production and the Sterling Hendricks Award (2007) for contributions to agriculture. Professor Dale was elected a Fellow of the American Institute of Chemical Engineers in 2011 and a Fellow of the American Institute of Medical and Biological Engineers in 2015. In 2017 he was elected a Fellow of the American Academy of Inventors. He has published over 300 archival journal papers and has received 63 US and international patents. His research interests are the relationships between energy use and prosperity and the design of integrated agroenergy systems to sustainably produce sustainable fuels, chemicals and food.