National Center for Sustainable Transportation

POLICY BRIEF

What to Make of Biofuels? Understanding the Market from 2010 to the Present, and Projecting Ahead to 2030 Given Current Policies

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Issue

Low-carbon biofuels are projected to play a critical role in the early and middle stages of a transition away from petroleum fuels, and they will likely have a longer-term role in uses like aviation and maritime transportation that require energy-dense fuels in high volumes. Policies over the last decade aimed to move low-carbon biofuels squarely into U.S. markets. While these policies encouraged the production of conventional biofuels such as crop-based ethanol, cellulosic fuels that can have a significantly lower carbon footprint per unit energy failed to materialize at commercial scale (Figure 1). A research team at the University of California, Davis examined the track record of the past decade for clues as to why this happened, and looked forward to 2030 to point to how current policies are likely to still fall short in delivering low-carbon biofuels that can reach scales needed for these hard-to-decarbonize sectors.

The findings highlight barriers to low-carbon biofuel development that would safeguard against unintended consequences such as additional emissions from land use changes or higher food prices that can come from competition with the use of crops for fuel. The research involved synthesis and analysis of fuel trends under California's Low Carbon Fuel Standard (LCFS) and the U.S. Renewable Fuel Standard (RFS) as captured by jurisdiction-level data, technoeconomic analyses of biofuel costs drawn from the academic literature, and academic and popular press accounts of biofuel market trends.

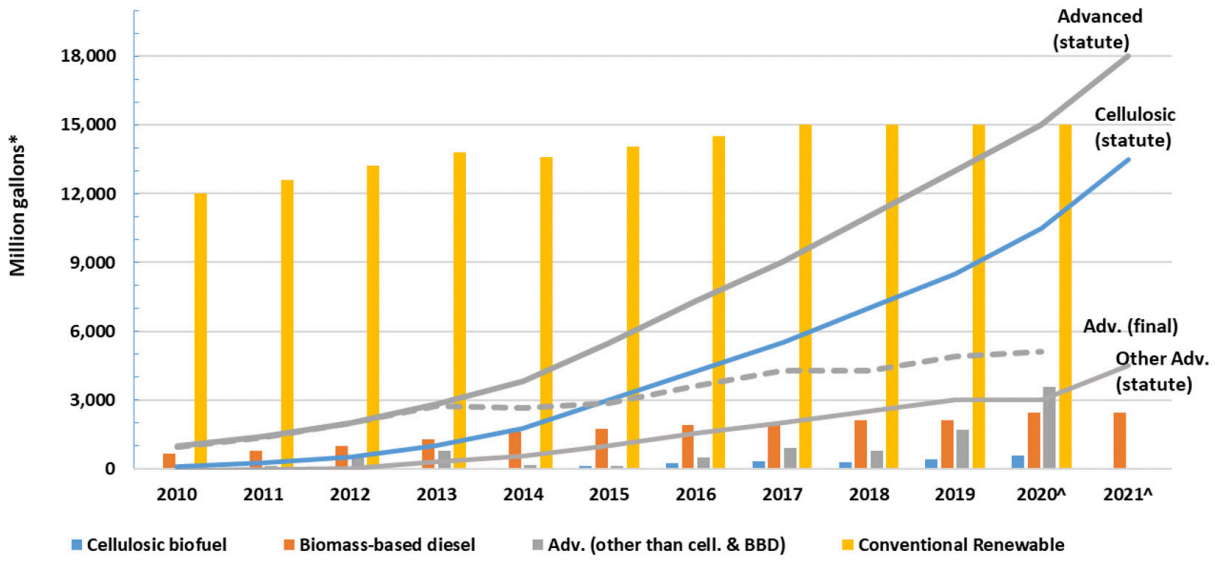

*Figure 1. RFS Volume Standards: implemented (columns) and statutory levels (lines). *Gallons for biomass-based diesel (BBD); ethanol-equivalent gallons for other mandates. "Adv. (other than cell. & BBD)" and "Other Adv. (statute)" refer to residual advanced fuel after adjusting for ethanol-equivalent gallons covered through the cellulosic and biomass-based diesel mandates, with the statutory line indicating the statutory minimum of 1 billion gallons. ^Calculated before annual volumes finalized, using the statutory minimum for BBD. Data source: (Bracmort 2020)[1]*

Key Research Findings

Non-conventional, low-carbon cellulosic biofuels failed to commercialize at scale in the 2010s due to a mix of policy shortfalls, underappreciated technical challenges, financing difficulties in the wake of the Great Recession, and the mid-decade dip in oil prices. Alternative fuel policies did not provide a compelling incentive for development of the cellulosic fuels with the greatest low-carbon promise, since policy compliance could be achieved using conventional ethanol and biomass-based diesel. Large-scale cellulosic fuel pioneer plants encouraged by grant and loan policies were inadequately vetted at smaller scale, leading to technical issues and high costs. Pioneer plant failures combined with an unfavorable capital environment to complicate financing, while policy rewards could only be reaped once production began.

A scaled-up cellulosic biofuel industry is unlikely to develop by 2030 under current alternative fuel policies. Existing fuels like biomethane and hydrotreated renewable diesel that emerged under the first decade of low-carbon fuel policies, along with electricity used as a fuel in battery-electric vehicles, will likely suffice to meet California's LCFS 2030 targets. The shape of the RFS over the next decade remains highly uncertain. The few U.S. cellulosic biofuel production facilities under construction, even if successful, could not spur enough additional facilities to produce sufficiently large volumes in that timeframe. Moreover, there are no clear low-cost winners yet among potential cellulosic conversion technologies and biomass supply chain configurations.

Secure safeguards against unintended consequences of using biomass are not in place. The RFS and LCFS do consider the emissions impacts of land use change from production of some biofuels, but the approach is not comprehensive. For example, fats left over from other production processes—like used cooking oil or tallow—that are used to make renewable diesel, could still impact food prices or land conversion through international vegetable oil markets, but existing policies don't consider land use impacts of these fuels. Risk of land use change can also accompany substantial market growth of certain biofuels, which would go beyond the scope of early analyses of these fuels. The U.S. policies, unlike those in the European Union, place no explicit limit on eligible volumes for most biofuels, and they lack clear guidelines for feedstock sourcing to minimize market impacts on food and land.

Policy action to encourage research and development, provide upfront financing options for new production, and develop clear biomass feedstock sourcing guidelines could incentivize a very low carbon biofuel industry beyond 2030. Further research and development to explore business case models for biofuels and other bio-coproducts could help resolve the persistent technical hurdles and high costs facing the industry. Once promising technologies are identified, new financing approaches could help overcome high upfront capital costs and allow technology vetting in smaller facilities. Financing could supplement existing alternative fuel policies that provide incentives for the fuel once production begins. Finally, clear guidelines for biomass sourcing that account for other potential uses of the feedstock or the land that produces it would diminish the risk of potential stranded assets due to unintended environmental or social consequences.

More Information

This policy brief is drawn from "What Happened and Will Happen with Biofuels? Review and Prospects for Non-Conventional Biofuels in California and the U.S.: Supply, Cost, and Potential GHG Reductions," a white paper from the National Center for Sustainable Transportation, authored by Julie Witcover of the University of California, Davis. The full paper can be found on the NCST website at https://ncst.ucdavis.edu/project/what-happened-biofuels-review-biofuel-costs-and-evolution-us.

For more information about the findings presented in this brief, contact Julie Witcover at jwitcover@ucdavis.edu.

[1] *Bracmort, K. 2020. "The Renewable Fuel Standard (RFS): An Overview (Updated April 14, 2020)." R43325. Congressional Research Services. https://fas.org/sgp/crs/misc/R43325.pdf.*

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