

Advanced Biofuels of the Future: Atom–Economical or Energy–Economical?

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Project Goals: This study aims to identify critical factors that are important in the assessment and selection of new conversion strategies and biofuels. We specifically assess interplay of three key factors: (1) carbon yield, (2) conversion energy efficiency at biorefinery, which indirectly determines excess electricity production, and (3) biofuel type and quality.

Biofuels are sustainable energy sources which could lead to the reduction of GHG emissions by displacing fossil fuels consumption. However, limited resource availability warrants that optimal strategies for efficient utilization of biomass are exploited. This study aims to identify the critical factors that must be considered in the selection of target biofuels and development of new deconstruction and conversion strategies. To this end, a high level carbon and energy analysis of two idealized representative biomass-to-fuel strategies is performed to identify critical trade-offs. The impact of process energy requirements and byproduct (electricity) production, as well as the impact of fuel quality are studied by extending the boundary of analysis to include the end-use of the produced fuel and electricity in the transportation sector. Results show that the interplay of three critical factors (i) carbon efficiency, (ii) conversion energy efficiency at biorefinery, and (iii) biofuel quality must be considered to fairly understand the merits and potential of new conversion strategies. In addition, results from detailed technoeconomic analysis reported in the literature are used to validate our assumptions and modeling approach, as well as conclusions and insights.

This material is based upon work supported by the Great Lakes Bioenergy Research Center, U.S. Department of Energy, Office of Science, Office of Biological and Environmental Research under Award Number DE-SC0018409.