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Integrating Biofuels and Bioproducts Production

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Short Commentary

Biomass is a highly adaptable energy source. Although it can be converted to biofuel for automotive use, it can also be used to make plastics, fertilisers, lubricants, industrial chemicals, and a variety of other products that are currently made with petroleum or natural gas [1].

These "bioproducts" are made from biomass and can be processed alongside biofuels in an integrated biorefinery. This plan takes a more sustainable, cost-effective, and streamlined approach to using our country's biomass resources [2]. Bioproduct revenue adds value to biorefinery activities, enhancing their economics and allowing for more cost-competitive biofuels.

Producing products alongside fuels has long been a proven strategy for increasing capital gains in the petrochemical industry. For instance, approximately 75% of the volume of a barrel of crude oil is used to make fuels, generating $935 billion in revenue [3]. Petrochemicals, on the other hand, account for just 16 percent of a barrel of crude. Despite their smaller volume, chemicals generate almost as much revenue as fuels ($812 billion in chemicals revenue) [4]. The Energy Department's Bioenergy Technologies Office (BETO) is working on strategies to increase the economic viability of advanced biofuel development by leveraging revenue from bioproducts. BETO has sponsored many successful initiatives in the past year that have established novel approaches to the development of sustainable chemicals and materials from biomass resources.

Lygos Inc., for example, revealed in early 2015 that it had successfully achieved pre-pilot-scale development of malonic acid from pure non-food sugar as a model for cellulosic sugars [5]. Pharmaceuticals, flavours, fragrances, and electronic and metal production processes all use this high-value chemical. In a programme sponsored in part by BETO, pre-pilot-scale manufacturing was completed at the Advanced Biofuels Process Demonstration Unit at Lawrence Berkeley National Laboratory. BETO has also granted Lygos additional funding through the Small Business Vouchers Pilot, an initiative that helps small businesses bring next-generation renewable energy technology to market faster by offering access to expertise and advanced facilities at DOE national laboratories. Lygos will continue to collaborate with national laboratories to test their proprietary technologies on cellulosic sugars in order to validate biomass-based feedstocks for their product via this platform [6].

Genomatica, a renewable chemical company, created a microbe-based method for converting cellulosic sugars to butanediol (BDO), a chemical used in hard plastics, INVISTA's Lycra® spandex, and other high-performance fabrics. This BETO-funded project advanced the technical readiness for BDO production and demonstrates the value of sustainable chemical production within a biorefinery [7]. BETO will continue to investigate viable technology paths for co-products in the future, with some already in the works. Several companies and universities in Wisconsin, Minnesota, California, Colorado, and Georgia were awarded DOE funds

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in 2015 to develop integrated processes for the development of advanced biofuels and products.

Continued incorporation of bio-based chemicals and materials into the biofuel production process could result in new feedstock demands, technical advances, and economic opportunities [8]. These products will help to make advanced biofuels more cost-effective, increase energy security, reduce greenhouse gas emissions, and create jobs in the United States.

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