**Summary/Abstract for Public Release**

Engineering enzymes for crystalline PET substrates
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Given concerns over waste plastics accumulation in the natural environment and landfills, the energy and greenhouse gas (GHG) emissions associated with plastics manufacturing, and the lack of current recycling infrastructure to address plastics circularity, there is increasing global interest in and urgency towards the development of new, cost-effective, and energy-efficient technologies for plastics recycling. Together, NREL and Birch Biosciences aim to develop an enzyme that can fully depolymerize crystalline PET from textile or unrecyclable bottle waste in isolation or as part of an enzyme cocktail with no energy-intensive amorphization step. To accomplish this goal, we will leverage a high-throughput enzyme screening system and apply new computational tools based on deep learning for enzyme design. Additionally, current enzymatic PET recycling employs distillation of dilute ethylene glycol from water, which is extremely energy intensive. Thus, an important second objective of this project is to develop a markedly more efficient ethylene glycol recovery approach to enable energy-efficient, fully circular PET recycling, towards decarbonization of this promising recycling approach.

This project could enable best-in-class enzymes and substantially more efficient separations methods to be developed and demonstrated in the pilot facility being constructed by Birch Biosciences, as a prelude to an eventual demonstration-scale and ultimately industrial-scale facility. If successful, this project would contribute to BETO goals associated with the Conversion sub-program related to waste feedstocks and contribute to BETO goals around increasing rates of plastics recycling.

This effort will be co-led by Johan Kers (Birch Biosciences) and Gregg Beckham (NREL).