Primary Applicant	Spero Energy, Inc
Subrecipients	National Renewable Energy Laboratory (NREL) Industrial Ecology Research Services, LLC (IERS)
Principal Investigators	Ian Klein, PhD (Spero Energy, Inc.) Gregg Beckham, PhD (NREL) Sangwon Suh, PhD (IERS)
Project Title	SPERLU Selective Process for Efficient Removal of Lignin and Upgrading

To meet the growing demand for bio-based chemicals and improve the profitability and efficiency of the emerging biorefinery industry, lignin is an abundant and attractive feedstock. Spero Energy, Inc. has developed a proprietary and patent-pending technology, the Selective Process for Efficient Removal of Lignin and Upgrading (SPERLU^{TM}). The technology is one-step catalytic deconstruction and upgrading of lignin in lignocellulosic biomass to produce 2-9 phenol products in a liquid stream. The SPERLU^{TM} process has been demonstrated and vetted on a lab-scale to convert intact lignin from lignocellulosic biomass in excellent yields $\geq$ 50% (based on lignin) to high-value phenols such as dihydroeugenol (DHE), isoeugenol, propyl syringol, ferulate, and coumarate while co-producing delignified solid cellulose. The phenolic products can be separated and further upgraded through catalytic or biological means.

Through the proposed work, Spero will perform a detailed kinetic study of the SPERLU process to produce phenolic monomers from lignin. The resulting kinetic data will be used to design and construct a mini-pilot scale reactor which will be used for production of large amounts of phenolic products for biological and catalytic upgrading. Collaboration with the National Renewable Energy Laboratory (NREL) will be used to further upgrade the SPERLU products through biological means into valuable chemicals such as vanillin and benzoate. Spero Energy will also investigate the use of the lignin derived phenolic monomers as replacements for BisPhenol A (BPA). A comprehensive life cycle analysis of the SPERLU process and monomer upgrading will be performed in collaboration with Industrial Ecology Research Services, LLC. At the conclusion of this project, Spero expects to have sufficient fundamental data on the SPERLU process and biological monomer upgrading to be ready for large-scale pilot testing in preparation for a commercial launch. It is anticipated that commercialization of the SPERLU^{TM} process could lead to significant increases in the profitability of the emerging biorefinery industry through valorization of lignin.