University of California, San Diego (UCSD) proposes to partner with Gross-Wen Technologies, Algix, and the National Renewable Energy Laboratory to establish first-in-class carbon sequestering molecular films for bio-based direct air capture (DAC). The project, entitled "Biomolecular Films for Direct Air Capture of CO_2," will integrate core competencies from all partners, including computational biology, protein and algal strain engineering, algal mass cultivation, biomass upgrading, and TEA/LCA, in order to develop a conversion process demonstrating production of fuel intermediates and bioplastic from atmospheric CO_2 via bio-based DAC. Successful implementation of the proposed project offers dramatic economic and sustainability benefits relative to conventional DAC technologies, notably including little-to-no CAPEX/OPEX, and seamless integration with conventional algal growth systems that utilize either point source CO_2 streams, or conventional DAC technologies, synergistically reducing costs.

UCSD's project lead and the Principal Investigator for this proposal is Dr. Karsten Zengler, a pioneer in systems biology approaches that involve both experimental and computational methods to unravel genome organization and community composition, metabolism, and microbial metabolite exchanges. His team has generated a series of first-in-class genome-scale metabolic models for diverse microbes, including green algae and diatoms. Dr. Zengler also has extensive experience in developing and deploying next generation molecular biology tools, exemplified by the recent R&D successes in experimental genome annotation, new translatomics (Ribo-seq) techniques, and ultra-low input omics methods. UCSD will build upon this expertise to inform rational strain engineering strategies enabling bio-based DAC.