High productivity and yields of microalgae grown in open air raceway ponds for biofuel production require active inorganic carbon delivery to the water medium. In most research (and commercial) operations this carbon is supplied in excess from external, often limiting CO2 sources. However, TEA/LCAs show that this approach can dramatically limit the broader application of algae-based biofuels. To address this gap, our team will use top biofuel algae strain candidates to (1) identify the minimum concentration of dissolved inorganic carbon (DIC) that can support baseline and target productivities and yields to improve CO2 use efficiency, (2) test the enhancement of productivity and yields of candidate algae by supplying “CO2” in the form of bicarbonate , (3) test a patented CO2-based conversion technology as an improved carbon source on open raceway ponds at an established algae facility and (4) test this technology on scalable sources (waste streams) of CO2 using open raceway ponds. Our team includes an algae expert and algae raceway facility (Duke University, Johnson), an inorganic carbon chemist and developer of CO2 conversion technology (UC Santa Cruz, Rau), and algae TEA/LCA and commercialization experts (B&D, Beal and Archibald; Bucknell, Sills).