

# Southwest Microalgal Research and Testing (SMaRT)

REGIONAL RESOURCE HUBS FOR PURPOSE-GROWN ENERGY CROPS  
Funding Opportunity Announcement (FOA) Number: DE-FOA- 0003209

## Topic Area 1a: Algae

### Summary

Algae farming is considered among the most efficient at assimilating carbon into a bioenergy feedstock crop, with up to 10X higher yield per acre compared to most terrestrial crops. Despite this promise, a main knowledge gap identified during BETO's June 2023 "Purpose Grown Energy Crops Workshop" was the lack of validated algae crop data in production ponds/raceways of at least 1 acre (4000 m<sup>2</sup>).<sup>1</sup> To close the data gap between the longer-term, public data generated through efforts (ATP<sup>3</sup> and DISCOVER) at small "mini-pond" scale (4.2 m<sup>2</sup>) and large-scale (>1 acre ponds), we will utilize multiple pond sizes and locations to identify the effects of scale on yield. One end goal will be to integrate empirical data collected at multiple scales with validated computational simulations and hydrodynamic modeling to enable a **Digital Twin** (or virtual testbed) to help guide, de-risk, and mobilize the algae industry. The Digital Twin will make an *in-silico* environment accessible to test innovations for improved algae farming operations and designs. Ultimately, such virtual farms will integrate crop performance, carbon chemistry, physics, sensor feedback, economics, and life cycle analysis, to identify approaches to improve performance and decision making for large scale cultivation of algae.

We propose a multi-site approach focused on southern California, Arizona, and New Mexico where we can leverage existing commercially relevant algae cultivation infrastructure. The proposed cultivation systems for this work comprise various algae raceways/ponds that are paddlewheel driven and range in scale from 75 m<sup>2</sup> to 8000 m<sup>2</sup>. Large-scale cultivation will include cultivation trials at Viridos in 400m<sup>2</sup> and 4,000m<sup>2</sup> manufactured raceways and at Green Stream Algae in raceways at 4,000 to 8000 m<sup>2</sup>. In addition, we will test sloped raceways driven by pumps instead of a paddlewheel, side by side with conventional 100 m<sup>2</sup> raceways at AzCATI. With the inclusion of large-scale raceways up to 2 acres, as well as sloped raceways, we will close gaps in understanding scales needed to meet the minimum raceway size suggested by the DOE Algae Farm Model (10 acres, 40,000 m<sup>2</sup>). This project will evaluate two main approaches for algae cultivation: 1) Semi-continuous cultivation under nutrient replete conditions for biomass production and 2) 2-stage cultivation (growth and induction) to enhance the production of lipids.