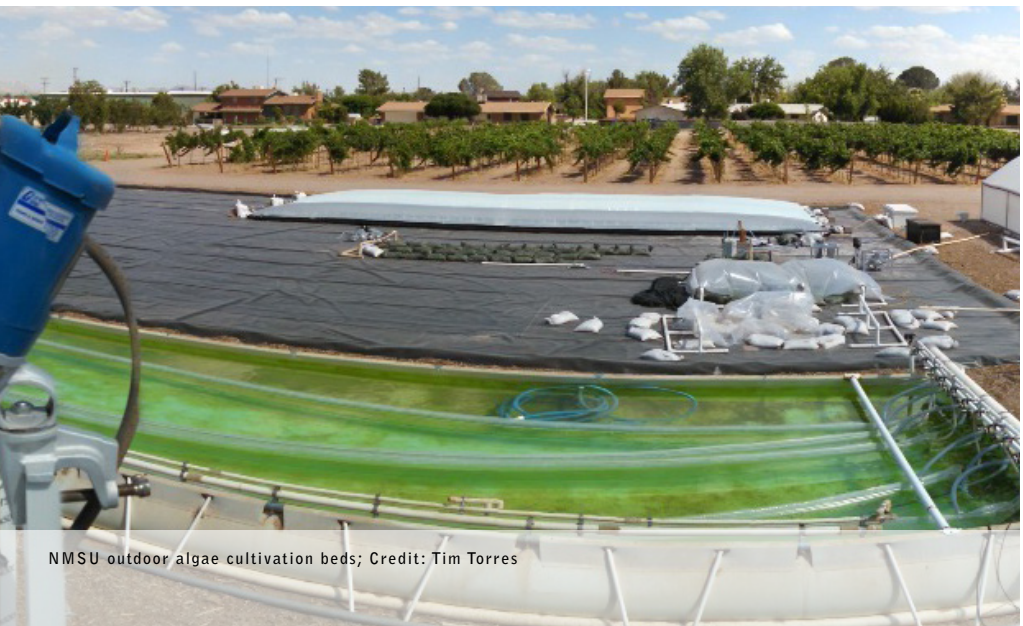
BIOALGAL ENERGY

Bioalgal energy development can play a key role in creating a future that better utilizes alternative fuels and resources. Through *Energize New Mexico*, New Mexico EPSCoR is investing in research aimed at overcoming the challenges of developing algal biomass in a desert environment where water is precious. Faculty and students from Eastern New Mexico University (ENMU), New Mexico State University (NMSU), the University of New Mexico (UNM), and Santa Fe Community College (SFCC), as well as colleagues from the New Mexico Consortium (NMC), are working together to develop bioalgal energy as a sustainable, economically viable component of a renewable energy portfolio in New Mexico.

In Year 1, an algal turf scrubber was installed at ENMU to study the use of dairy effluent to grow algae. The scrubber acts as a filter, removing chemicals from wastewater while allowing sunlight to support the growth of algae. NMSU conducted outdoor summer growth tests for a heat-tolerant alga from volcanic hot springs, *Galdieria sulphuraria* at the Fabian Garcia Science center in Las Cruces outdoor testbed. *Chlorella sorokiniana*, a more temperate strain was grown in outdoor, closed cultivation systems during February-May, 2014. Publications based on initial research added to our knowledge about the composition of biofuels produced from algal biomass, nutrient removal rates by G. *sulphuraria*, and development of molecular markers in outdoor photobioreactor systems. UNM purchased and installed instrumentation to serve as the core of a Small-scale Experimental Ecological Design (SEED) facility. Researchers at UNM successfully encapsulated algae in both silica gels and alginate as part of a process to increase algae productivity. Santa Fe Community College was awarded a $50,000 Infrastructure Seed Award for instrumentation that will improve their ability to monitor algal growth in their college's industrial-scale bioreactors and provide additional research experiences for their students.



NMSU outdoor algae cultivation beds; Credit: Tim Torres

USING ALGAE TO CLEAN URBAN WASTEWATER

Urban wastewaters are laden with high levels of organic carbon and different forms of nitrogen (N) and phosphorous (P) that must be removed prior to discharge into receiving waters. Although traditional wastewater treatment plants (WWTPs) equipped with secondary treatment meet the discharge standards for organic carbon (BOD), they fall short of meeting the discharge standards for nutrients.

The Bioalgal Component Team at NMSU conducted a study that proposes a potentially energy-positive WWTP process specifically intended for warm-to-hot, arid regions such as New Mexico. The study presents the nutrient removal ability of an algal extremophile, *Galdieria sulphuraria*, with a broad genetic capacity for organic carbon utilization. Both laboratory assessment of nutrient removal capability and outdoor cultivation results are presented in the full study.

The team involved concluded that *G. sulphuraria* can be cultivated in primary effluent to achieve high nutrient removal efficiencies and at removal rates comparable to other strains. *G. sulphuraria* is especially useful because it can thrive in extreme conditions, including an acidic environment with temperatures up to 56°C, conditions that many competitors, predators, viruses, and pathogens cannot tolerate. These results bode well for further optimization of the overall system to reduce the footprint of an algae-based wastewater treatment system.

Dr. Peter Lammers; Credit: NMSU