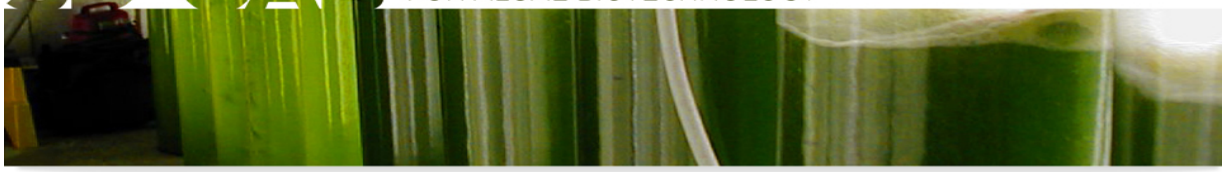
SD-CAB SAN DIEGO CENTER FOR ALGAE BIOTECHNOLOGY



Advancing Research and Development of Sustainable Energy from Algae

Statement of Dr. Stephen Mayfield, UC San Diego
Before the Assembly Committee on Water, Parks & Wildlife
Oversight Hearing on The Salton Sea: Current Efforts and Future Opportunities
February 22, 2013

I want to thank Chairman Hueso, Assemblyman Perez, and the Committee for this opportunity to testify, and to provide some perspective on how the Salton Sea and Imperial Valley are uniquely positioned to help address our State's alternative transportation fuel needs, as well as to mitigate some of the significant challenges faced by the Salton Sea.

The San Diego and Imperial County region has become the epicenter of algal biotechnology development, and at UC San Diego, the San Diego Center for Algae Biotechnology is both spearheading the cutting edge academic research, as well as developing workforce training programs that will further enable the emerging algae industry. Attached for the hearing record to my statement today is a brief summary document on SD-CAB, and of the EDGE workforce training program, which was made possible by a grant from the California Labor & Workforce Development Agency. Also on the education front, we recently received a grant from Google to establish a Massive Open Online Course, or "MOOC" in the field of sustainable energy, food and fuel. We are excited about this opportunity and believe it will help to educate a larger sector of society on the challenges we face in our energy future, and will also allow us to highlight the scientific discovery that will enable us to meet these grand challenges (a summary of our MOOC is also included for the hearing record).

Our philosophy at SD-CAB is to work closely with commercial partners to transfer the basic research in algal biotechnology from lab to application as rapidly as possible, by promoting interactions and collaborations between academic and commercial sector partners. In practice, SD-CAB is a statewide enterprise, involving academic collaborators from UC Davis, UC Riverside, UCLA, and UC Berkeley. In this capacity, we are a logical continuation of UC's proud history as the research arm of the State of California. SD-CAB is supported by a $9 million award from the US Department of Energy, and a $2 million award from the California Energy Commission (CEC), which enabled us to establish the CEC-funded California Initiative for Large-Molecule Sustainable Fuels (CILMSF), housed at UC San Diego. In support of the broader context of my testimony, I would like to provide the Committee with a brief update on some recent developments on the algae R&D front, stemming from the Initiative.

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This Initiative was launched by the CEC in 2011, and I am pleased to report that its output has exceeded my original expectations of what I thought might be possible. In the short time that CILMSF has been operational, our researchers and students have generated over 30 published articles and patents, and many more are currently under review or awaiting publication. The topics of these papers range from metabolic engineering of algae for altered fatty acid (fuel) accumulation to crop protection and co-product production, all focused on helping biofuels to become economically viable. These publications demonstrate the rapid progress being made toward environmentally and economically sustainable drop-in fuels produced from algae, and represent accomplishments of which we can all be proud. The spin-off technologies from these discoveries can also help to create high paying jobs in California in a sustainable and environmentally friendly manner, further demonstrating how public funds can be leveraged to support this important work. Additionally, this productivity demonstrates both the promise and potential of algae as a viable commercial-scale alternative fuel feedstock, as well as highlighting the need for sustained efforts to help bring it from the R&D phase into the commercial phase, here in California, in places like the Imperial Valley.

No one will be surprised by my optimistic perspective on algal biotechnology and the potential of algae to provide low-carbon fuels for California, but this should not be viewed as just my own "biased" viewpoint - these are peer-reviewed scientific achievements, enabled by the research which the State of California has helped to generate. It may well be that new feedstocks, in addition to algae, emerge with equal or even greater promise to create the volumes of drop-in, low-carbon fuel that will be required for California to meet its mandated targets. Until research identifies such organisms, I would continue to argue that it is critical for the state to look carefully at how it intends to allocate its precious research resources to achieving the volumes of alternative fuels and related greenhouse gas emissions that the State is mandated to deliver.

To this end, I am increasingly concerned that the State has not yet focused in such a manner, and is instead continuing to provide support and generate expectation for non-scalable alternative fuels – i.e. the funding of multiple small awards for first-generation technologies that may indeed be able to produce low carbon fuels, but which lack any meaningful commercial-scale potential. This is not to be critical of these awards or technologies; my colleagues and I at SD-CAB have long championed the concept of "silver buckshot", meaning many small solutions that ultimately add up to a significant contribution. However, California is at a point where it is critical to consider allocation of future R&D resources in a more focused manner, and to projects that have the potential to reach a scale that can have a meaningful impact on California's mandated alternative fuel production targets and GHG reductions. In the absence of such a focused effort, California risks fostering various "one-off" type projects in which there may be some marginal benefit, but not realistic and viable commercial-scale potential, whether because of insurmountable technological, resource, or capital limitations. Such projects will require continued (and considerable) public support in order to operate, and even then will never achieve the scale required to meet these goals.

Under the LCFS, California is required to produce about 4 billion gallons of low carbon fuel, with at least 50% GHG reduction, by 2020; that is only 7 years away, and will require production of **11 million gallons of low carbon fuels per day.** California leads the world as

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a direct result of **the innovations and inventions made here**, and biofuel deployment at the scale required under the LCFS will only be achieved after these innovations and inventions have reduced the price of low-carbon fuels to a level that competes with current fossil fuel costs.

Continuing to subsidize currently non-competitive low-carbon fuels will neither promote the required innovation to make low carbon fuels cost competitive, nor will they provide even a fraction of a percent of the low carbon fuels which California is mandated to deliver in just 7 years. If cost-competitive low-carbon fuels can be realized, the commercial sector will rapidly invest the tens of billions of dollars required to generate production of the 10 million gallons per day we need. Without such cost-competitive fuels, few if any significant commercial investments will be made, and California will be forced to either revisit or reconsider the LCFS, or will be required to invest billions of dollars in public funds to make low-carbon fuels that are not economically competitive, and will therefore require addition subsidies in order to be sold. This approach is neither environmentally nor economically sustainable. Supporting job growth and reducing greenhouse gas emissions by making low-carbon fuels economically viable is the ONLY sensible route to meeting California's LCFS targets. Any investment strategy that does not focus on this hard reality will neither meet the mandated targets, nor provide a sound return on the taxpayers' investment.

As others have already pointed out, and which we support unequivocally, the Imperial Valley is uniquely positioned to be at the forefront of commercial-scale production of algae. It has all the ingredients – abundant sunlight, available non-arable land, and an experienced agricultural workforce. Because algae does not require fresh or potable water to thrive and reproduce, brackish or saline sources could be used, and production facilities could even be sited as appropriate adjacent to the Salton Sea, to take advantage of proximity to those sources. This would provide the added advantage of helping to mitigate the "playa effect" along the Sea's receding shoreline, where wind-generated dust clouds could threaten public health in adjacent communities and further up and down the Valley.

My perspective, and that of my industry and academic colleagues, is that California has before it a unique opportunity to catalyze an industry by encouraging the development and deployment of algae biotechnology in the Imperial Valley. We have already seen the research side of this equation result in a meaningful economic impact in the San Diego region (see attached 2011 letter from SANDAG). If successful, these technologies will also generate a significant number of well-paying jobs for the regional economy, in addition to helping to meet GHG reduction targets, and mitigating other environmental challenges. Algae is a proven feedstock for drop-in transportation fuels, and large-scale commercial production of algae is underway in Texas, New Mexico, and elsewhere. Once these production enterprises take root and become more robust, the likelihood of similar economic engines emerging within California becomes far less likely. If California can create an environment in which industry is incentivized to consider in-state production, in places like the Imperial Valley, the long-term economic and environmental benefits could be significant. However, time is a factor, and the window is narrowing; the market **<u>will</u>** demand commercial scale production of algae, and the question is just where it will occur, and who will reap the economic benefits.

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I really hope it is us here in California, and that it starts here in this Valley. SD-CAB and its colleagues throughout the state stand ready to assist this Committee, and the State, however we might be able to in order to realize this achievable goal. Thank you again for this opportunity.

Sincerely,

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