

Algal Biofuels Strategy
Proceedings from the November 19–20, 2013, Workshop
Mesa, Arizona

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Office of Energy Efficiency and Renewable Energy

Bioenergy Technologies Office

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Introduction

The U.S. Department of Energy's (DOE) Bioenergy Technologies Office's (BETO's) Algae Program hosted the Algal Biofuels Strategy Workshop at Arizona State University on November 19–20, 2013, to discuss the research and development (R&D) needed to achieve affordable, scalable, and sustainable algae-based biofuels.

The workshop provided a forum to discuss, reassess, and reprioritize technical R&D needs in light of the progress made across the industry in the five years since DOE organized the National Algal Biofuel Technology Roadmap¹ Workshop. The Algal Biofuels Strategy Workshop convened university, national laboratory, industry, advocacy, and government stakeholders to consider algal biofuel research priorities and current barriers to commercialization. DOE will use the outcomes of these discussions to assist with strategy development and evaluation of the National Algal Biofuels Technology Roadmap.

Bioenergy Technologies Office

An overarching strategic goal of BETO's (also referred to as “the Office”) is to develop sustainable, commercially viable biomass technologies that enable a domestic bioenergy economy, reducing America's dependence on foreign oil and greenhouse gas emissions.

Algae-based biofuels can contribute to expanding the domestic advanced biofuel resource potential. Algal biofuels have the ability to exploit high biomass productivity, non-arable land, brackish or salt waters, and waste nutrients and effluents to produce hydrocarbon-based fuels such as renewable diesel and jet, or ethanol.

Developing algal feedstocks to achieve advanced biofuel goals requires breakthroughs along the algae biomass value chain. BETO's Algae Program focuses its efforts on demonstrating progress toward achieving high-yield, low-cost, environmentally sustainable algae biomass production and logistics systems that produce biofuel intermediate feedstocks well-suited for conversion to fuels and other valuable products. The Office strives to achieve the performance goal of \$3 per gallon gasoline equivalent (gge) advanced algal biofuel by 2030.

The Algae Program's R&D project portfolio focuses on achieving technical progress in overcoming barriers in four key components of the algal feedstock supply and logistics system. These four areas are as follows:

- Productivity of large-scale algae cultivation;
- Harvest and processing efficiency;
- Resource efficiency (water, nutrient, electricity, and land use); and
- Yield of stable biofuel intermediates that can be converted to advanced biofuels.²

¹ U.S. DOE 2010. National Algal Biofuels Technology Roadmap. U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Biomass Program. bioenergy/pdfs/algal_biofuels_roadmap.pdf

² *Bioenergy Technologies Office Multi-Year Program Plan*. DOE/EE-0915. Washington, DC: U.S. Department of Energy, 2013. bioenergy/pdfs/mypp_may_2013.pdf

The Algae Program funds national laboratories, universities, industry, consortia, and a variety of state and regional partners to perform strategic R&D activities within these components.

Workshop Process

The Algal Biofuels Strategy Workshop was conducted within an “open-space” format where attendees were encouraged to propose breakout session topics, set the agenda, and self-convene to discuss key issues. The open-space facilitation practice was used to tap into the creativity and leadership of attendees and ensure that the Algae Program was not limiting the scope and breadth of potential conversations. Due to time constraints, not all proposed topics were discussed; however, are all captured in Appendix D.

Twenty-eight breakout sessions formed during this process, each led by a volunteer “Convener” from the attendees. Workshop participants selected the breakout sessions they wished to attend. Conveners posed the following questions during each breakout session:

1. What is the time-horizon for this topic or issue; will this impact algal biofuel production in the near, mid, or long term?
2. Has this topic been included in the National Algal Biofuel Technology Roadmap; and if not, should it be?
3. What is the BETO Algae Program role in furthering this topic or addressing this issue?

Answers to these questions and key issues that emerged during discussions were recorded by scribes within the rooms, as well as by the Conveners on large flip-chart sheets. These sheets (or “posters”) were then displayed in the plenary room for all participants to review. This workshop proceedings report is a collection of the key points gathered by the scribes during these sessions, as well as the transcribed content from the posters, organized into relevant subject matter chapters.

Please Note: These proceedings summarized the results of a public workshop sponsored by DOE/EERE in Phoenix, Arizona, on November 19–20, 2013. The views and opinions of the workshop attendees, as summarized in this document, do not necessarily reflect those of the United States government or any agency thereof, or do their employees make any warranty, expressed or implied, or assume any liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights.

A single report synthesizing the results from the Algal Biofuels Fall and Spring Strategy Workshops will be published ahead of the Office's annual Biomass 2014 Conference, in Washington D.C.

Workshop Outcomes

A number of reoccurring themes emerged during the Algal Biofuels Strategy Workshop breakout sessions. Attendees encouraged the Algae Program to continue to focus on multiple technologies

along the algal biomass supply and logistics chain—from algae strain identification and development, through downstream processing, to biofuels and bioproducts. Attendees also encouraged the Algae Program to continue to include technology-enabling efforts, such as developing models, genetic toolkits, databases, standards, and protocols, and to continue to fund research and analysis projects at lower technology readiness levels that could prove to have potentially high impacts.

Attendees would like to see the Algae Program increase its role in facilitating collaboration with regulatory agencies, particularly with the U.S. Environmental Protection Agency (EPA) and U.S. Department of Agriculture (USDA) on policies affecting the industry, such as carbon dioxide (CO₂), genetically modified organisms (GMO), crop designation, agricultural practices, and tax incentives. In addition to CO₂ regulatory policies, participants identified a need for an increased investigation of CO₂ resource availability, transportation, cost, delivery, and utilization.

Participants noted that the Algae Program could do more to facilitate partnering and research collaboration through funding opportunity announcements (FOAs), workshops, conferences, and committees. Improved collaboration among industry, national laboratories, universities, and government agencies would move the entire industry forward while avoiding the duplication of efforts.

Algae Program staff participated in the breakout sessions and received valuable input on these and many other issues from the Algal Biofuels Strategy Workshop attendees, as documented in the session notes that follow. Due to the desire to accommodate geographically diverse stakeholders and refine the concepts raised at this event, the Algae Program will hold a second workshop in the spring of 2014.