Biotechnology Industry Organization

Comments to the California Air Resources Board

On the Technology Assessment, Supply and Availability Chapter

September 12, 2011

The Biotechnology Industry Organization (BIO) appreciates the opportunity to submit comments on the draft "Technology Assessment, Supply and Availability" chapter (the chapter). These comments supplement the comments BIO submitted on July 15, 2011 on the "Supply and Availability," and "Technology Assessment" chapter outlines. BIO understands that these two outlines have been consolidated to make up this one chapter.

BIO is the world's largest biotechnology organization with more than 1,100 member companies worldwide. Among its membership, BIO represents over 85 leading technology companies in the production of conventional and advanced biofuels and other sustainable solutions to energy and climate change challenges. BIO also represents the leaders in developing new crop technologies for food, feed, fiber, and fuel.

BIO member companies represent many of the low carbon fuel producers that will supply the State of California with the fuels for Low Carbon Fuel Standard (LCFS) compliance. Government programs, including the LCFS, are especially important to industry because when they become stable, long-term predictable policies, they become the basis upon which we are able to secure investment for the commercialization of our fuels.

The feasibility of the LCFS depends on an accurate projection of low carbon fuels commercialization. Through BIO's comments and participation on the California Air Resources Board (CARB) Advisory Panel on LCFS implementation, BIO aims to serve as a resource to CARB staff and provide information on this expected commercialization directly from the companies that are making investments and working to commercialize low carbon fuels.

Advanced Molecules, Such As Butanol, Renewable Diesel and Other Renewable Hydrocarbons

As the chapter suggests on page 20, some of the challenges under the LCFS associated with increasing requirements for biofuels may be addressed through commercial blending of advanced biofuels such as butanol, or through the use of unblended drop-in fuels such as renewable diesel from algae or other advanced feedstocks. In the chapter, CARB staff also project the Flex Fuel Vehicles (FFVs) and infrastructure that would be necessary to meet the federal Renewable Fuel Standard and the additional demand from the LCFS.

BIO believes CARB has underestimated both the rate and variety of advanced biofuel penetration into the California market under a well-structured LCFS. We elaborate on this assertion in subsequent sections. Given the uncertainty of commercialization timelines, we urge CARB staff to consider adding additional scenarios that anticipate rapid uptake of a variety of advanced biofuels, including cellulosic and algae-based fuels, biobutanol, hydrogenation derived renewable diesel, solar fuels, waste derived fuels, and other advanced molecules.

Also, it appears that CARB staff has made some very aggressive calculations on what the E85/FFV market will support from a volume basis of ethanol that will have to be consumed in California in order to meet the LCFS compliance requirements. BIO and its members would appreciate a clarification on the source(s) of these calculations and to the following related questions: (1) Are these calculations supported by current market trends?; (2) Will CARB put in

place any incentives to facilitate these calculations/volumes?; and, (3) is CARB working with the federal government to ensure that federal policies will support the projected growth?

Cellulosic and Advanced Biofuel Commercialization Timelines

BIO believes that the EIA projections of cellulosic biofuel commercialization used by CARB in its analysis are an overly conservative representation of how long it will take for cellulosic fuels to continue scaling-up. EIA significantly under-predicted the increase in commercial corn ethanol volumes. BIO believes that EIA is similarly under-predicting cellulosic scale up.

At least 15 commercial cellulosic projects representing nearly 200 million gallons of production a year are now under construction and scheduled to come on line by 2014 (see Appendix A), Many of these projects are backed by loan guarantees from the U.S. Departments of Agriculture (UDSA) and Energy (DOE). USDA is expected to announce an additional round of loan guarantees for commercial cellulosic projects before the end of the fiscal year.

In addition, there are a host of advanced biofuel technologies that do not depend on commercialization of cellulosic biomass conversion technology. Advanced biofuels such as advanced alcohols and renewable hydrocarbons can be produced from feedstocks such as sugarcane and starch as cellulosic conversion technologies mature. Several commercial non-cellulosic advanced biofuels projects are now under development and can be expected to provide advanced biofuel to the California market. BIO therefore disagrees with CARB's conclusion that advance biofuels will be unable to provide the volumes necessary to meet the LCFS requirements.

We urge CARB to consider adding additional scenarios that anticipate rapid uptake of a variety of advanced biofuels, including cellulosic and algae-based fuels, biobutanol,

hydrogenation derived renewable diesel, solar fuels, waste derived fuels, and other advanced molecules.

Cellulosic and Advanced Biofuels Volumes in California

Because California offers a premium for low carbon fuels such as cellulosic and advanced biofuels, BIO and its Members believe that a proportionately higher volume of cellulosic biofuels will be sold into the California market compared to other states. BIO recommends that CARB staff consider including in the chapter another scenario where the majority of all low carbon biofuels produced in the United States will be sold into the California LCFS market. Some BIO members plan to sell a high proportion of their initial output in California.

Fuel Categories

In Section B, BIO recommends that CARB include an additional type of fuel category (see proposed subsection "13. Solar Fuels" below) and has included a proposed definition for this emerging category. BIO recommends CARB consult with the U.S. Department of Energy's Advanced Research Projects Agency-Energy (ARPA-E), which is currently funding a project area on solar fuels, to ensure CARB's category definition is consistent with that used by DOE.

> *13. Solar fuels*
> This emerging category describes liquid fuels that are directly produced by biological or chemical means powered by sunlight. The fuels are produced from the sun's energy directly. Solar fuel processes are designed to leverage or mimic photosynthesis, such as requiring sunlight, CO_2 and water as inputs.

Conclusion

Thank you for the opportunity to submit these comments on the draft "Technology Assessment, Supply and Availability" chapter. This work is very important to the future of the biofuels industry in California and throughout the country, and BIO would like to continue to

serve as a resource to CARB staff as they finalize the chapter. Please do not hesitate to contact BIO for any additional data or perspective that would assist CARB staff in making more aggressive and realistic projections of what the advanced and cellulosic biofuels industry will be able to achieve with respect to LCFS compliance in California.

APPENDIX A

Current and Projected Production

BIO has tracked cellulosic ethanol projects since 2007 and made the results public through the Biofuels and Climate Change blog: http://biofuelsandclimate.wordpress.com/about/. Proposed projects have been added to and removed from the list on a regular basis as information about their status has been updated. Inclusion in the list requires that the project demonstrate a funding and/or feedstock procurement agreement in place; many of the funding agreements are in the form of state or federal support for the project.

A. Operating Biorefineries as of 2011

Name	Location	Fuel	Capacity (mgpy):	Start Year
AE Biofuels	Butte, Mont.	Cellulosic Ethanol	0.15	2008
Coskata	Madison, Pa.	SynGas/Ethanol	0.04	2009
DuPont Danisco Cellulosic Ethanol LLC	Vonore, Tenn.	Cellulosic Ethanol	0.25	2009
Fiberight, LLC	Blairstown, Iowa	Cellulosic Ethanol	5.6	2010
Gulf Coast Energy	Livingston, Ala.	FT Diesel/Ethanol	0.4	2009
Kior	Houston, Texas	Wood chips Renewable Crude	0.23	2010
KL Energy Corp.	Upton, Wyo.	Cellulosic Ethanol	1.5	2008
Mascoma	Rome, N.Y.	Cellulosic Ethanol	0.2	2009
POET	Scotland, S.D.	Cellulosic Ethanol	0.02	2009
Terrabon	Bryan, Texas	Ketones/ Green Gasoline	0.1	2011
Verenium	Jennings, La.	Sugarcane Ethanol/Cellulosic Ethanol	1.4	2009
Total			**9.89**	

B. Biorefineries Expected to Begin Production in 2011

Name	Location	Fuel	Capacity (mgpy):	Start Year
ZeaChem	Boardman, Ore.	Cellulosic Ethyl Acetate/Ethanol	0.25	2011
New Production in 2011			**0.25**	
Cumulative Total			**10.14**	

C. Biorefineries Expected to Begin Production in 2012

Name	Location	Fuel	Capacity (mgpy):	Start Year
Alpena Biorefinery	Alpena, Mich.	Ethanol, Biobutanol	.985	2012
BlueFire Ethanol	Lancaster, Calif.	Syngas Ethanol	3.9	2012
Fulcrum BioEnergy/Sierra Biofuels	Reno, Nev.	Syngas Ethanol	10.5	2012
ClearFuels Technology	Commerce City, Colo.	FT Diesel	1.5	2012
GeoSynFuels	Golden, Colo.	Cellulosic Ethanol	0.25	2012
PureVision Technology	Fort Lupton, Colo.	Biomass Sugars/ Ethanol/Butanol	2	2012
Qteros	Chicopee, Mass.	Cellulosic Ethanol	0.001	2012
New Production in 2012			**19.136**	
Cumulative Total			**29.276**	

D. Biorefineries Expected to Begin Production in 2013

Name	Location	Fuel	Capacity (mgpy):	Start Year
Enerkem, Inc.	Pontotoc, Miss.	Syngas Ethanol	20	2013
ICM Inc.	St. Joseph, Mo.	Cellulosic Ethanol	1.5	2013
Ineos Bio	Vero Beach, Fla.	Cellulosic Ethanol	8	2013
New Production in 2013			**29.5**	
Cumulative Total			**58.776**	

E. Biorefineries Expected to Begin Production in 2014

Name	Location	Fuel	Capacity (mgpy):	Start Year
DuPont Danisco Cellulosic Ethanol	Tenn.	Cellulosic Ethanol	25	2014
Gulf Coast Energy	Cleveland, Tenn.	FT Diesel/Ethanol	25	2014
Kior	Columbus, Miss.	Wood chips, Renewable Crude, Diesel and Gasoline	11.5	2014
POET	Emmetsburg, Iowa	Corn/Cellulosic Ethanol	25	2014
Vercipia	Highland Co., Fla.	Cellulosic Ethanol	36	2014
New Production in 2014			**122.5**	
Cumulative Total			**181.276**	

F. Biorefineries Expected to Begin Production in 2015

Name	Location	Fuel	Capacity (mgpy):	Start Year
Abengoa Bioenergy	Hugoton, Kan.	Cellulosic Ethanol	11.4	2015
BlueFire Mecca LLC	Fulton, Miss.	Syngas Ethanol	18	2015
ClearFuels Technology	Collinwood, Tenn.	FT Diesel	20	2015
Coskata, Inc.	Boligee, Alabama	Syngas Ethanol	55	2015
Frontier Renewable Resources	Kinross, Mich.	Cellulosic Ethanol	40	2015
Terrabon	Port Arthur, Texas	Ketones/ Green Gasoline	1.3	2015
New Production in 2015			**145.7**	
Cumulative Total			**326.976**	

G. Biorefineries Expected to Begin Production After 2015

Name	Location	Fuel	Capacity (mgpy):	Start Year
AE Biofuels	Keyes, Calif.	Cellulosic Ethanol	14	
DuPont Danisco Cellulosic Ethanol	Midwest, U.S.	Cellulosic Ethanol	25	
Genahol/Powers Energy	Lake County, Ind.	Syngas Ethanol	32	
Lignol	Ferndale, Wash.	Ethanol		
Logos/EdenIQ	Visalia, Calif.	Cellulosic Ethanol	10	
UOP Renewables	Kapolei, Hawaii	Pyrolysis oil		
West Biofuels	Yolo Co., Calif.	Cellulosic Ethanol	0.182	