State of California
AIR RESOURCES BOARD

The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways

RESEARCH PROPOSAL

Resolution 13-19

June 27, 2013

Agenda Item No.: 13-6-1

WHEREAS, the Air Resources Board (ARB or Board) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2759-276, entitled "The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways," has been submitted by the University of California, Berkeley; and

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee has reviewed and recommends for funding:

> Proposal Number 2759-276 entitled "The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways," submitted by the University of California, Berkeley, for a total amount not to exceed $400,000.

WHEREAS, the Research Division staff has reviewed Proposal Number 2759-276 and finds that in accordance with Health and Safety Code section 39701, this research project will provide essential information on the most cost effective and environmentally friendly pathways for commercially producing renewable drop-in fuels in California.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division approves the following:

> Proposal Number 2759-276 entitled "The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways," submitted by the University of California, Berkeley not to exceed $400,000.

BE IT FURTHER RESOLVED that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the

research effort proposed herein, and as described in Attachment A, in an amount not to exceed $400,000.

I hereby certify that the above is a true and correct copy of Resolution 13-19, as adopted by the Air Resources Board.

Tracy Jensen

Tracy Jensen, Clerk of the Board

ATTACHMENT A

"The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways"

Background

In order to achieve California's climate and air quality goals, emissions from transportation will need to decline significantly in the coming decades. ARB's Low Carbon Fuel Standard (LCFS) calls for a reduction of at least 10 percent in the carbon intensity of California's transportation fuels by 2020. The LCFS incentivizes the production and sale of low carbon-intensity transportation fuels by establishing a set of performance standards in the form of declining carbon-intensity levels that fuel producers and importers must meet each year for their fuel pools beginning in 2011.

Studies have indicated that biofuels will be needed to achieve long-term energy and climate goals in the transportation sector, especially for aviation, shipping, heavy-duty and off-road vehicles that cannot be easily electrified. Certain industry studies contended that the fuels necessary to comply with the LCFS standards in the 2015 timeframe will not be available when they are needed, but these studies are both pessimistic with respect to availability, and also focus on the assertion that the LCFS will have large cost impacts on consumers. Although drop-in fuels are essential to meeting California's climate change goals, the technology and infrastructure needed to commercially produce these fuels through economically viable pathways still requires significant research.

Objective

This project will investigate the technology, feasibility, costs, barriers, and environmental impacts associated with producing drop-in fuels on a commercial scale for use in California.

Methods

The researchers will gather existing information and analyze the technology and feasibility, and the life-cycle costs and environmental impacts, at both demonstration and commercial scales. This information will be gathered from a thorough literature reviews and direct contact with laboratory researchers and technoeconomic modelers at the EBI, JBEI, and the National Renewable Energy Laboratory (NREL). Using Excel-based process summary sheets and the CA-GREET model, the life-cycle analysis will focus on all life-cycle phases of fuels (biomass production, feedstock transportation, biorefining, fuel storage and distribution, fuel combustion), relevant environmental inventory metrics (GHG, criteria air, and toxic emissions, water withdrawal and consumption) and environmental impact categories (global warming potential, human and ecological health damage potential, resource depletion, water quality and quantity). The researchers will perform a geospatial analysis, using ArcGIS, to estimate where facilities could potentially be located in order to maximize production while minimizing environmental impacts. Research needs and barriers to the success of these technologies will be identified, as well as strategies to overcome these barriers. Strategies to monitor and track progress of these technologies as well as supplies and costs will also be developed.

Expected Results
This research project will provide essential information on the most cost effective and environmentally friendly pathways for commercially producing renewable drop-in fuels in California.

Significance to the Board
The project results will provide data that will influence LCFS policy in California or other jurisdictions worldwide that are developing their own LCFS-like programs. If this research leads to the development of lower carbon fuels, it will be to the benefit of regulated parties under the LCFS and to California consumers. In the longer term, the data will inform many other initiatives of ARB that might support the need for drop-in fuels.

Contractor: University of California, Berkeley

Contract Period:
36 months

Principal Investigator:
Arpad Horvath, Ph.D.

Contract Amount:
$400,000

Basis for Indirect Cost Rate:
The State and the University of California, Berkeley have agreed to a 10 percent indirect cost rate.

Past Experience with the Principal Investigator:
ARB staff has had several positive experiences working with Dr. Arpad Horvath on previous ARB-funded research projects. The research team from the University of California, Berkeley (UC Berkeley) has a wealth of experience with life cycle analysis (LCA), biofuels, infrastructure, and the other scientific areas relevant to this project. Professors Horvath and McKone have approximately 50 collective years of relevant experience. They have published over 220 articles and reports in the areas of air and water quality, human and ecological impact assessment, product and service LCA, transportation and industrial energy analysis, and product life-cycle optimization.

Prior Research Division Funding to the University of California, Berkeley:

Year	2012	2011	2010
Funding	$1,320,000	$754,264	$801,587

BUDGET SUMMARY

University of California, Berkeley

"The Future of Drop-In Fuels: Life-Cycle Cost and Environmental Impacts of Bio-Based Hydrocarbon Fuel Pathways"

DIRECT COSTS AND BENEFITS				
1.	Labor and Employee Fringe Benefits	$	148,611	
2.	Subcontractors	$	0	
3.	Equipment	$	0	
4.	Travel and Subsistence	$	0	
5.	Electronic Data Processing	$	0	
6.	Reproduction/Publication	$	0	
7.	Mail and Phone	$	0	
8.	Supplies	$	0	
9.	Analyses	$	0	
10.	Miscellaneous	$	217,613[1]	
	Total Direct Costs			$366,224
INDIRECT COSTS				
1.	Overhead	$	33,776	
2.	General and Administrative Expenses	$	0	
3.	Other Indirect Costs	$	0	
4.	Fee or Profit	$	0	
	Total Indirect Costs	$	33,776	
TOTAL PROJECT COSTS				**$400,000**

[1] This cost is not employment on the UC Berkeley campus, because the person is employed by LBNL, but is not a subcontract either because LBNL is run by UC Berkeley.