OMB Number: 4040-0010
Expiration Date: 08/31/2011

Project/Performance Site Location(s)

Project/Performance Site Primary Location ☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name: Algenol Biofuels Inc.

DUNS Number: 8003999040000

* Street1: 2301 N Brazosport BLVD

Street2:

* City: Freeport County: Brazoria

* State: TX: Texas

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: 77541-2303 * Project/ Performance Site Congressional District: TX-014

Project/Performance Site Location 1 ☐ I am submitting an application as an individual, and not on behalf of a company, state, local or tribal government, academia, or other type of organization.

Organization Name:

DUNS Number:

* Street1:

Street2:

* City: County:

* State:

Province:

* Country: USA: UNITED STATES

* ZIP / Postal Code: * Project/ Performance Site Congressional District:

Name of the Applicant: Algenol Biofuels Inc.

Principal Investigator: Dr. Craig R. Smith, Chief Operating Officer, Algenol Biofuels Inc.

Title: Integrated Pilot-Scale Biorefinery for Producing Ethanol from Hybrid Algae

Objectives: Algenol Biofuels Inc., together with The Dow Chemical Company, is proposing to construct an integrated pilot-scale biorefinery (Topic Area 1) that will convert carbon dioxide into ethanol using Algenol's proprietary DIRECT TO ETHANOL™ algae technology. The biorefinery will be located in Freeport, Texas on an existing Dow facility. The integrated pilot-scale biorefinery will consume two dry tonnes per day of carbon dioxide obtained from industrial emissions and will produce more than 100,000 gallons of ethanol per year. The project will also create or save more than 300 well-paying high-tech jobs in Texas, Maryland, and Florida and validate the commercial viability of a new breakthrough energy technology that could eventually create billions of dollars of economic value and thousands of new jobs.

Project Description: DIRECT TO ETHANOL™ technology is based on over-expressing in blue-green algae the genes for fermentation pathway enzymes found widely in nature. The resulting metabolically enhanced hybrid algae actively carry out photosynthesis and utilize carbon dioxide to make ethanol inside each algal cell. The ethanol diffuses through the cell wall into the culture medium and then evaporates, along with water, into the headspace of an enclosed, sealed photobioreactor. The ethanol-water vapor is then condensed, collected as a liquid, and distilled into fuel grade ethanol. Algenol currently has hybrid algae that produce ethanol at a rate equivalent to about 6,000 gallons per acre per year. The productivity of these algae is currently being evaluated

REDACTED
EXEMPTION 4

Potential Impact of the Project: Once the pilot biorefinery is fully functional, Algenol intends to construct multiple commercial production facilities that will each have a production capacity of more than 250 million gallons of ethanol per year. Based on an analysis by a premier economic consulting firm, during the three-year construction period of a commercial production facility, the project would generate over $1 billion in total economic output and would reach a peak employment of approximately 3,000 jobs. At completion, the project would annually generate over $700 million in total economic output and create approximately 2,800 permanent jobs. Algenol's DIRECT TO ETHANOL™ process has several advantages over competing methods for ethanol production. Algenol's process does not use food as a feedstock, does not require arable land and does not use large amounts of fresh water. Most importantly, it consumes large amounts of carbon dioxide, has a large positive net energy balance, and can substantially reduce net green house gas emissions. Once the Algenol process has been demonstrated to work at pilot-scale, it can be expanded to produce ethanol in very large amounts sufficient to allow the United States to reduce its dependence on imported oil.

Major Participants: Algenol has collaborative agreements with The Dow Chemical Company, the National Renewable Energy Laboratory, Membrane Technology & Research Inc., and The Georgia Institute of Technology. Dow will provide land on its facility in Freeport, Texas, assist in the development of specialized plastics, evaluate various ethanol-water separation technologies, evaluate and test various water treatment, handling and disposal options, provide engineering, analytical, EH&S, and administrative support, and supply all saltwater requirements.

PROJECT NARRATIVE COVER SHEET
Recovery Act – Demonstration of Integrated Biorefinery Operations
Funding Opportunity Announcement Number: DE-FOA-0000096
CFDA Number: 81.087 Renewable Energy Research and Development

Applicant Information	
Applicant Name:	Algenol Biofuels Inc.
Project Title:	Pilot-Scale Integrated Biorefinery for Producing Ethanol from Hybrid Algae
Major Project Subcontractors:	The Dow Chemical Company, Georgia Institute of Technology, NREL, MTR Inc.
Major Project Vendors:	Exemption 4
Key Individuals:	Craig Smith, Ed Legere, Steve Gluck, John Coleman, Ron Chance

Topic Area (Select ONLY one)

Each applicant is allowed to submit only one application to this FOA. Applicants that submit to none or more than one topic area will be excluded from further review. Select one and only one topic area below.

☒ Topic Area 1	☐ Topic Area 3	☐ Topic Area 5
☐ Topic Area 2	☐ Topic Area 4	☐ Topic Area 6

Life-cycle Greenhouse Gas Emissions Reduction (mandatory for Topic Areas 5 and 6. Important – See Note):

Technical Description		
Feedstock(s):	Carbon Dioxide	
Primary Product:	Ethanol	
Co-Products:	None	
Location of Proposed Facility:	Freeport, Texas	
Throughput of Proposed Facility (dry tonnes of feedstock per day):	Two (2) dry tonnes of carbon dioxide per day	
Conversion Technology:	☐ Biochemical	☐ Thermochemical
	☒ Algae	☐ Other (Describe)

Short Description: The proposed biorefinery will make ethanol directly from CO_2 and seawater using hybrid algae in sealed, clear plastic 4,500L proprietary flexible film photobioreactors through its patented Direct to Ethanol™ technology – all powered by the sun, with approximately 17 acres of photobioreactors and additional supporting areas for testing, distillation, and product storage in Freeport, Texas.

Project Financing Description

Exemption 4

This form is required. It must be completely filled in and be included as the cover page for the "Project Narrative" (FOA, Subpart IV.C. b.). This form may contain confidential /business proprietary information IF it properly marked, but it must not contain any Personally Identifiable Information (PII). This form will count toward the page limit stated in the FOA, Subpart IV.C.b. Non-compliant applications will not be reviewed and will not be eligible for selection.

Application Table of Contents

I. SF 424 – Application for Federal Assistance

II. Project Site Location (PPSL.doc)

III. Other Attachments

a. **Project Abstract**

b. **Project Narrative** (Project.pdf)

i. **Appendix 1** – Resume File (resume.pdf)

ii. **Appendix 2** – Budget File (SF424A.xls)

iii. **Appendix 3** – Budget Justification File (BudgetJustification.xls)

iv. **Appendix 4** – Letters of Commitment

1. Dow Chemical Company (DowLetter.pdf)
2. The Georgia Institute of Technology (GATechLetter.pdf)
3. Membrane Technology & Research Inc. (MTRLetter.pdf)

v. **Appendix 5** – Subaward Budget Files, Including Budget Justification

1. Dow Chemical Company (Dow424.xls)
2. The Georgia Institute of Technology (GATech424.xls)
3. Membrane Technology & Research Inc. (MTR424.xls)

vi. **Appendix 6** – Budget for Federally Funded Research and Development Center (FFRDC) Contractor File (NREL.pdf)

vii. **Appendix 7** – Authorization From Cognizant Contracting Officer for FFRDC (FFRDC_Auth.pdf)

viii. **Appendix 8** – Environmental Questionnaire (Enviro.pdf)

ix. **Appendix 9** – Project Management Plan (pmp.pdf)

x. **Appendix 10** - Historical, Current, and Planned Technical and Financial Data (TechandFinData.pdf)

xi. **Appendix 11** – Business and Commercialization Plan (BusComPlan.pdf)

xii. **Appendix 12** – Pro Forma (ProForma.xls)

xiii. **Appendix 13** – Intellectual Property Statement and Supporting Documentation (ProjectIP.pdf)

xiv. **Appendix 14** – Process Flow Diagram and Supporting Data (PFD_Data)

xv. **Appendix 15** – Life-Cycle GHG Emission Reduction Data (LCA_GHG.xls)

xvi. **Appendix 16** – Petroleum Displacement Analysis (Petro.doc)

xvii. **Appendix 17** – Project Execution Plan (ProjExecPlan.pdf)

Proprietary Information: The data contained on pages 6-10 of the Project Narrative; pages 3-6 and 12-13 of Environmental Questionnaire; pages 1-10, 16-18 and 20 of the Business and Commercialization Plan; and pages 2-4 of the IP Statement and all information contained the files named Lifecycle Energy and Greenhouse Gas Emissions, SF424A, Budget, Subaward Budget Files, Process Flow Diagram, Project Management Plant and Project Executive Plan have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award.

Paragraphs in this application's respective files that are preceded by an asterisk (*) contain proprietary information that Algenol Biofuels requests not be released to persons outside the Government, except for the purposes of review and evaluation.

I. PROJECT GOALS AND OBJECTIVES.

Algenol Biofuels Inc. ("the Company") is developing and intends to commercialize DIRECT TO ETHANOL™ technology invented by Mr. Paul Woods and Dr. John Coleman between 1984 and 1996 and patented in the U.S. in 2001 and 2004 (US Patent Nos. 6,306,639 and 6,699,696). DIRECT TO ETHANOL™ technology uses hybrid algae that make ethanol from carbon dioxide. More than $70 million in investment capital has been secured from Algenol's founders to finance the initial development of DIRECT TO ETHANOL™ technology. Over the last three years about $30 million of this capital has been invested in research and development, and the technology is now ready for advancement to a pilot-scale integrated biorefinery. By means of this response to DOE Funding Opportunity Announcement Number DE-FOA-0000096 Algenol is seeking financial support to build and operate a pilot-scale DIRECT TO ETHANOL™ integrated biorefinery.

Project Goals and Objectives:

Exemption 4

Specific Aims and Targets:

Exemption 4

II. COMPANY DESCRIPTION.

Algenol Biofuels Inc. is a Delaware corporation with headquarters in Naples, Florida. Algenol has assembled a team of more than 100 employees and consultants to develop its technology from proof-of-principle to commercialization. The Company's management team has extensive experience in the energy

and biotechnology industries and has founded, financed, and built several successful publicly traded companies. The Company employs molecular biologists, marine biologists, biochemists, mechanical engineers, chemical engineers, financial professionals and project managers, including more than 40 Ph.D.'s. The Company employs two full time patent attorneys and has retained external patent law firms to represent its interests in jurisdictions both inside and outside of the United States. Algenol has an Advisory Board of distinguished scientists and engineers that actively advise the Company and has developed a broad range of research collaborations with leading academic institutions, such as The Georgia Institute of Technology, The University of Maryland Center for Marine Biotechnology, and the University of Hawaii.

The Company has research laboratories in Baltimore, Maryland and Germany that enhance and maintain selected hybrid algae for ethanol production. Both laboratories are equipped with state-of-the-art analytical technology and specialized algal growing rooms, as well as bench-top photobioreactors of varying designs from 0.5-liter to 80-liter capacity. The Company also has an advanced engineering lab in Baltimore where development, design and testing of photobioreactor, ethanol extraction and other system components are carried out.

The Company also operates a zero discharge, licensed aquaculture facility for research and development on five acres in Palm Beach County, Florida. This facility has a fully equipped laboratory and scientific staff on site and has already tested multiple photobioreactor designs and developed expertise in growing algae at large scale for more than a year under field conditions. Algenol is currently installing a Process Development Unit with 40 prototype commercial 4,500-liter bioreactors for the next phase of scale up and process development. Installation and initial operations will be completed by August 2009.

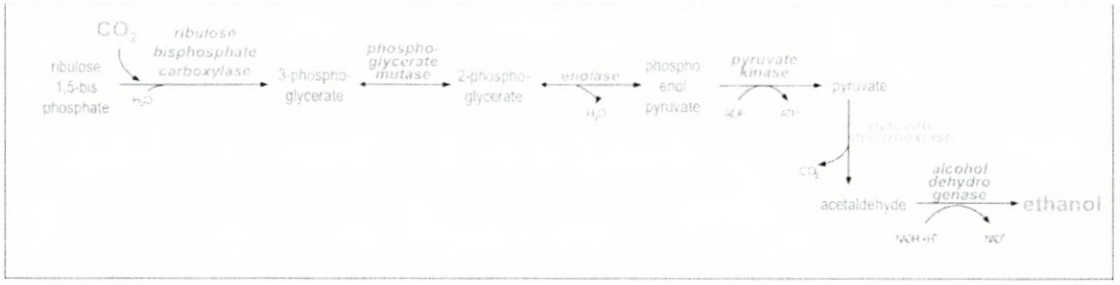
Figure 1: Algenol's Process Development Unit currently under construction in Florida

Exemption 4

III. TECHNOLOGY AND PROCESSES.

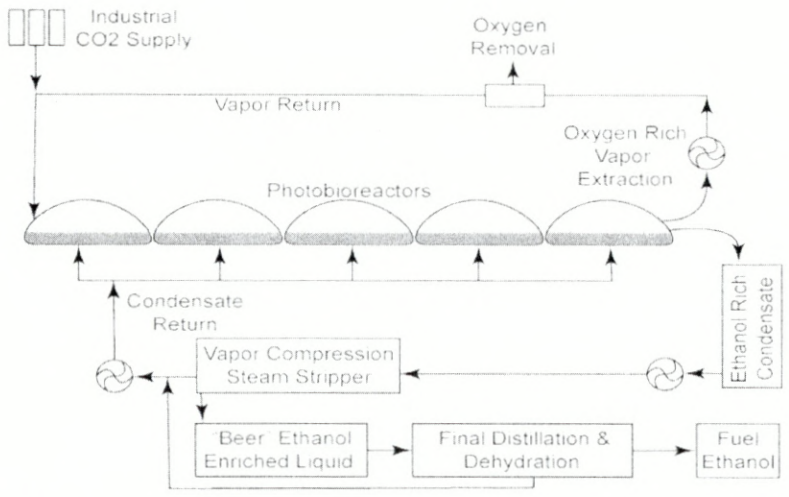
DIRECT TO ETHANOL™ technology involves over-expressing in blue-green algae the genes for fermentation pathway enzymes found widely in nature. These enzymes are pyruvate decarboxylase and alcohol dehydrogenase. The resulting metabolically enhanced hybrid algae actively carry out photosynthesis and utilize carbon dioxide as the feedstock for making ethanol inside each algal cell. The biochemical pathway for producing ethanol in the hybrid algae is shown in Figure 2.

Figure 2: Metabolic Pathway for Ethanol Production



The ethanol made inside the cell diffuses through the cell wall into the culture medium and then evaporates, along with water, into the headspace of an enclosed, sealed photobioreactor. The ethanol-water vapor condenses on the inner surface of the bioreactor headspace and is collected by gravity, concentrated, and then distilled into fuel grade ethanol.

Figure 3: Simple diagram of the DIRECT TO ETHANOL™ process



The central component of the DIRECT TO ETHANOL™ process is a proprietary 4,500 liter 5' x 50' flexible film photobioreactor made of polyethylene film with special additives and coatings. The photobioreactor contains seawater that has been treated to remove particulates and contaminants, added nutrients, and a large headspace above the seawater. The photobioreactor is inoculated with several gallons of a dense hybrid algae culture produced from stocks maintained in greenhouses on site. After hybrid algae inoculation, carbon dioxide from industrial emissions is introduced into the photobioreactor. The outdoor photobioreactor is exposed to sunlight that causes the algae to undergo photosynthesis, absorb carbon dioxide and produce ethanol. Because of the solar heat that accumulates in the photobioreactor, ethanol along with water evaporates into the headspace. Upon contact with the plastic film, the vapor condenses, runs down the sides of the

photobioreactor, and is collected in troughs that carry the ethanol-enriched condensate, by gravity, into a collection system. The ethanol-water mixture leaving the photobioreactor has an ethanol concentration of 0.5 to 2 percent (weight). The ethanol rich condensate is then pumped through a proprietary vapor compression steam stripping (VCSS) unit that further increases the ethanol concentration to ~35% (weight) producing an intermediate "beer" for further processing. If fuel ethanol is the desired product, the beer is processed through a conventional ethanol distillation system and subsequently dewatered by molecular sieves to produce fuel grade ethanol. Alternatively, the intermediate beer can be distilled to an 85% ethanol concentration and shipped to chemical companies for processing into ethylene, polyethylene, or many other biological polymers and co-products. For the purpose of validating this technology in the integrated biorefinery under this DOE FOA, this specific project will produce fuel ethanol from the intermediate beer. None of the intermediate beer will be processed into polyethylene or other polymers.

Exemption 4

Exemption 4

The Company now has more than 300 algal strains capable of producing ethanol and has an active research effort to produce more such strains. Specific candidate strains for further scale up for pilot scale production have been selected. The productivity of these algae is currently being evaluated in 1-liter to 80-liter laboratory photobioreactors and in multiple 300-liter outdoor photobioreactors under external environmental conditions.

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IV. PROJECT DESCRIPTION.

Exemption 4

Exemption 4

Exemption 4

Exemption 4

Exemption 4

Major Participants:

One of Algenol's Specific Aims in this project is to assemble a consortium of private industry, federal laboratories, and academic institutions that will contribute to the development and operation of the Algenol pilot-scale integrated biorefinery. Algenol has accomplished this goal by signing collaborative agreements with The Dow Chemical Company, The National Renewable Energy Laboratory (NREL), Membrane Technology & Research Inc. (MTR), and The Georgia Tech Strategic Energy Institute, a division of The Georgia Institute of Technology (Georgia Tech). MTR is currently conducting a 6-month engineering design study of various ethanol-water separation technologies, including computer process simulations. This research will be completed by October 2009. Georgia Tech has completed the analysis of the life-cycle environmental impacts of Algenol's process included in this proposal.

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Critical Success Factors:

Exemption 4

Exemption 4

V. Business Model and Forecast Commercial-scale Integrated Biorefinery Summary.

Exemption 4

Forecasted Commercial-scale Integrated Biorefinery Summary:

Exemption 4

VI. American Recovery and Reinvestment Act of 2009, P.L. 111-5 (Recovery Act) Information.

Algenol's pilot-scale integrated biorefinery will create jobs and economic growth, adding hundreds of millions of dollars of economic output to local and regional economies. Fishkind & Associates, Inc. conducted an economic impact study for a hypothetical integrated 40,000-acre, 250 million gallon per year DIRECT TO ETHANOL™ integrated biorefinery located in Texas. The analysis assumed the integrated biorefinery is built over 4-5 years in 8,000-acre increments or phases and that each phase is operational after construction. Impacts were measured separately for the construction and operational periods and were categorized as outputs (value added dollars and wages spent and re-spent), earnings (direct and indirect wages), and employment. During the three-year construction period, the project would generate $1.1 billion in total economic output and would reach a peak employment of 3,097 jobs. At completion, the project would annually generate $702.6 million in total economic output and create 2,830 permanent jobs. Algenol is targeting production of 10-20 billion gallons of ethanol by 2025. At these production levels the total economic impact is more than $40 billion per year and more than 100,000 jobs.

VII. Value Proposition.

Algenol's DIRECT TO ETHANOL™ technology also offers a compelling value proposition to consumers, the global environment, potential investors, and the United States.

Algenol today possesses the most advanced third generation biofuel technology in the United States. Algenol makes low cost ethanol directly from CO_2 and seawater using hybrid algae in sealed, clear plastic photobioreactors through its unique, patented Direct to Ethanol™ technology – all powered by the sun. Importantly, this is done without processing or transporting a separate biomass. At its core, Algenol has several components that come together in an integrated biorefinery from upstream CO_2 to final fuel grade ethanol product.

Algenol brings to this project significant capabilities and experience of its own and, together with its world-class partners, seeks to accelerate the commercialization of its Direct to Ethanol™ technology through application for funding by the Department of Energy.

Algenol's technology has culminated in hybrid algae that produce over 6,000 gallons of ethanol per acre per year, compared to corn at 400. Algenol's process achieves an energy balance of over 5 to 1 and a Life Cycle Carbon Analysis in a practical case that demonstrates that Algenol's Direct to EthanolTM production process has a carbon footprint that is merely 20% of petroleum (an 80% reduction from petroleum). Algenol intends to build commercial scale facilities that can produce ethanol for under $1.50 per gallon. Our group of people, companies, and institutions are extraordinarily talented and possess diverse skills that ensure Algenol can not only execute on its plan to build both this pilot-scale integrated biorefinery, but Algenol will bring the technology to commercial scale in under 5 years.

To the US government, we offer a method to make domestic transportation fuel that can make a substantial contribution to U.S. energy security, or at least free the U.S. from price volatility or supply restrictions based on the market dominance of the Organization of the Petroleum Exporting Countries (OPEC). We believe the DIRECT TO ETHANOL™ process could allow the U.S. to make 40-50 billion gallons of transportation fuel on as little as 100 miles square of desert or marginal land in the southern tier of the US. Presently, OPEC countries supply the U.S. with approximately 40 billion gallons of transportation fuel per year. We could replace the oil from unstable foreign sources with fuel produced here in the U.S.

To potential investors we offer an excellent business opportunity. Ethanol product pricing will be set by the commodity market and is expected to exceed a rack price of $2.50 per gallon of E85 by 2012. At these prices we could have net profit margins (after tax) in excess of 20% and a process that could be scaled to 50 billion gallons per year or more. If successful, the resultant return on investment would warrant the risks associated with an investment in Algenol's DIRECT TO ETHANOL™ technology.

Algenol will employ thousands of people in the future, and many at very high wages. Algenol has detailed conceptual blueprints completed for the pilot-scale integrated biorefinery on Dow's land in Freeport Texas. Algenol has completed detailed engineering work as well. In our application we allow 11 months for Award Budget Period One (often referred to as Phase I), and this is largely due to getting permits and through the DOE approval process. Algenol, with the DOE's assistance, is largely ready to build a pilot-scale integrated biorefinery today and most certainly as soon as possible after the award.

Algenol has already demonstrated its ability to attract the very best talent, execute on its plan, and scale up working systems, all of these lead to a successful pilot-scale integrated biorefinery and ensures that the DOE's accomplishes its goal as well.

STATEMENT OF PROJECT OBJECTIVES
Algenol Biofuels Inc.
Pilot-Scale Integrated Biorefinery for Producing Ethanol from Hybrid Algae

A. PROJECT OBJECTIVES

Exemption 4

B. PROJECT SCOPE

The DOE Office of Energy Efficiency and Renewable Energy (EERE) has established performance goals. Among these goals are to: 1) dramatically reduce, or even end, dependence on imported oil; and 2) spur the creation of the domestic bio-industry. To that end, the Office of the Biomass Program is offering to fund integrated biorefinery projects under this FOA entitled "Demonstration of Integrated Biorefinery Operations". The FOA lists three main criteria for selection; 1) technical merit and rationale, 2) credible economics and competitive advantages that justify an award, and 3) knowledge and experience in project management.

Algenol and its collaborators, The Dow Chemical Company, National Renewable Energy Laboratory, Membrane Technology & Research Inc., and The Georgia Institute of Technology, have collectively prepared an application that is responsive to the selection criteria as detailed below.

Exemption 4

Exemption 4

C. TASKS TO BE PERFORMED

Exemption 4

Exemption 4

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Applicant Name: Algenol Biofuels Inc. Award Number: Total Project

Budget Information - Non Construction Programs

OMB Approval No. 0348-0044

Section A - Budget Summary

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. DE-FOA-0000096	81.087			$25,000,000	REDACTED EXEMPTION 4	
2.						
3.						
4.						
5. Totals		$0	$0	$25,000,000		

Section B - Budget Categories

6. Object Class Categories	Grant Program, Function or Activity				Total (5)
	(1) DE-FOA-0000096	(2)	(3)	(4)	
a. Personnel	REDACTED EXEMPTION 4				REDACTED EXEMPTION 4
b. Fringe Benefits					
c. Travel					
d. Equipment					
e. Supplies					
f. Contractual					
g. Construction					
h. Other					
i. Total Direct Charges (sum of 6a-6h)		$0	$0	$0	
j. Indirect Charges					
k. **Totals** (sum of 6i-6j)		$0	$0	$0	
7. Program Income					$0

Section C - Non-Federal Resources

(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) **Totals**
8. DE-FOA-0000096				
9.				
10.				
11.				
12. **Total** (sum of lines 8 - 11)				

REDACTED
EXEMPTION 4

Section D - Forecasted Cash Needs

	Total Budget Period 1	1st Quarter	2nd Quarter	3rd Quarter	4th quarter
13. Federal	$9,669,386	$2,342,099	$2,645,510	$2,758,464	$1,923,312
14. Non-Federal					
15. **Total** (sum of lines 13 and 14)					

REDACTED
EXEMPTION 4

Section E - Budget Estimates of Federal Funds Needed for Balance of the Project

	Future Funding Periods (Years)			
(a) Grant Program	(b) First - Phase !!	(c) Second	(d) Third	(e) Fourth
16. DE-FOA-0000096	$15,330,614	$0	$0	$0
17.				
18.				
19.				
20. **Total** (sum of lines 16-19)	$15,330,614	$0	$0	$0

Section F - Other Budget Information

21. Direct Charges

22. Indirect Charges

23. Remarks Per page 15 in the FOA, the funding is based on Phases / Periods not years. Accordingly, the Forecasted Cash Needs in section D above agrees to the Phase I Total Project costs in the Budget justification file (in our case this is an 11 month period). In Section E, again we based it on Budget Periods as directed by the FOA. We have yearly information available and have included that as well. All tabs are labeled accordingly.

PMC123.1 - Budget Justification for SF 424A Budget

Instructions and Summary

Award Number: DE-FOA-0000096
Award Recipient: Algenol Biofuels Inc.

Date of Submission: Jan-10
Form submitted by: Algenol Biofuels Inc.
(May be award recipient or sub-recipient)

Please read the instructions on each page before starting.
If you have any questions, please ask your DOE contact. It will save you time!

On this form, provide detailed support for the estimated project costs identified on the SF-424A form (Budget).

- The dollar amounts on this page must match the amounts on the associated SF-424A.
- The award recipient and each sub-recipient with estimated costs of $100,000 or more must complete this form and a SF-424A form.
- The total budget presented on this form and on the SF424A must include both Federal (DOE), and Non-Federal (cost share) portions, thereby reflecting TOTAL PROJECT COSTS proposed.
- For costs in each Object Class Category on the SF-424A, complete the corresponding worksheet on this form (tab at the bottom of the page).
- All costs incurred by the preparer's sub-recipients, vendors, contractors, consultants and Federal Research and Development Centers (FFRDCs), should be entered only in section f. Contractual. All other sections are for the costs of the preparer only.

SUMMARY OF BUDGET CATEGORY COSTS PROPOSED
(Note: The values in this summary table are from entries made in each budget category sheet.)

CATEGORY	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Total Costs	Project Costs %	Comments (Add comments as needed)
a. Personnel						
b. Fringe Benefits						
c. Travel						
d. Equipment						
e. Supplies						
f. Contractual						
Sub-recipient						
FFRDC						
Vendor						
Total Contractual						
g. Construction						
h. Other Direct Costs						
i. Indirect Charges						
Total Project Costs						

REDACTED
EXEMPTION 4

Additional Explanations/Comments (as necessary)

a. Personnel

Task #	Title	Position Title	Budget Period 1			Budget Period 2			Budget Period 3			Project Total Hours	Project Total Dollars
			Time (Hours)	Pay Rate ($/Hr)	Total Budget Period 1	Time (Hours)	Pay Rate ($/Hr)	Total Budget Period 2	Time (Hours)	Pay Rate ($/Hr)	Total Budget Period 3		
1. Generation 2A Receiver Design			10000		$423,000	600		$24,000	888		$31,880	11408	
EXAMPLE		Sr. Engineer	2000	$85.00	$170,000	200	$50.00	$10,000	200	$50.00	$10,000	2408	
ONLY!!!		Electrical engineers	6200	$35.00	$217,000	400	$35.00	$14,000	600	$35.00	$21,000	7280	
		Technician	1800	$20.00	$36,000	0	$0.00	$0	0	$0.00	$0	1880	
1.1	Appoint Algenol / Dow Chemical Joint Project Team												

REDACTED
EXEMPTION 4

Redacted

Exemption 4

REDACTED
EXEMPTION 4

		Total Personnel Costs

Additional Explanations/Comments (as necessary)

For existing employees, salary rates were based on actual. For new hires, their salary was based on industry standards for their respective position, experience and education. In all cases, we will be Davis-Bacon compliant. /s/ Craig R. Smith, M.D.

b. Fringe Benefits

	Budget Period 1	Budget Period 2	Budget Period 3	Total
Rate applied:		REDACTED		
Total fringe requested:		EXEMPTION 4		

A federally approved fringe benefit rate agreement, or a proposed rate supported and agreed upon by DOE for estimating purposes is required if reimbursement for fringe benefits is requested. Please check (X) one of the options below and provide the requested information, if it has not already been provided to the Contracting Officer, OR if it has changed since it was. Calculate the fringe rate and enter the total amount in Section B, line 6.b. ("Fringe Benefits") of form SF-424A.

___ **A fringe benefit rate has been negotiated with, or approved by, a federal government agency. A copy of the latest rate agreement is included with this application, and will be provided electronically to the Contracting Officer for this project.**
(When this option is selected, a presentation of the budget that demonstrates the appliction of the approved rate, to arrive at the proposed fringes benefits dollars should also be provided.)

XXX **There is not a current, federally approved rate agreement negotiated and available.**
(When this option is checked, the entity preparing this form shall submit a rate proposal in the format provided at the following website, or a format that provides the same level of information and which will support the rates being proposed for use in performance of the proposed project. Go to https://www.eere-pmc.energy.gov/forms.aspx and select PMC 400.2 Sample Rate Proposal.)

dditional explanation/comments (as necessary)

The Fringe Benefits rate is based on current actual and adjusted in the future periods for projected hiring salary levels.Currently a larger portion of our employess are senior level and as we expend they will represent a smaller portion of our staff. Since the majority of our fringe benefits is for healthcare insurance, the effect of this demographic change is that fringe benefits will be a higher percent of compensation. Please see the Indirect tab at the end of this file for the Fringe calculation.

c. Travel

PLEASE READ!!!

Provide travel detail as requested below, identifying total Foreign and Domestic Travel as separate items. Purpose of travel are items such as professional conference, DOE sponsored meeting, project management meeting, etc. The Basis for Estimating Costs are items such as past trips, current quotations, Federal Travel Regulations, etc.

All listed travel must be necessary for performance of the Statement of Projecct Objectives.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Purpose of travel	No. of Travelers	Depart From (not required for domestic travel)	Destination (not required for domestic travel)	No. of Days	Cost per Traveler	Cost per Trip	Basis for Estimating Costs
Budget Period 1							
REDACTED EXEMPTION 4							
						$0	
						$0	
						$0	
						$0	
International Travel subtotal							
Budget Period 1 Total						$	
Budget Period 2							
Domestic Travel							
REDACTED EXEMPTION 4							

Purpose of travel	No. of Travelers	Depart From (not required for domestic travel)	Destination (not required for domestic travel)	No. of Days	Cost per Traveler	Cost per Trip	Basis for Estimating Costs
REDACTED EXEMPTION 4							
Budget Period 2 Total						$	
Budget Period 3							
Domestic Travel							
REDACTED EXEMPTION 4							
Budget Period 3 Total						$	
PROJECT TOTAL						$	

Additional Explanations/Comments (as necessary)

In the interest of having a more reader-friendly schedule, column B above represents the number of trips, not the number of travelers on each trip (e.g. will not be traveling on 1 trip but for that entire task we estimate rips will be made by a combination of the personnel assigned to that task). The general assumption (based on past experience) is that each trip would be In the case of training the , their trips last @ of the training. We anticipated lower hotel rates due to the volume and ability to book in advance.

d. Equipment

PLEASE READ!!!

Equipment is generally defined as an item with an acquisition cost greater than $5,000 and a useful life expectancy of more than one year. Further definitions can be found at 10 CFR 600 found on the PMC Recipient Resources Forms page at https://www.eere-pmc.energy.gov/Forms.aspx#regs .

List all proposed equipment below, providing a basis of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying its need as it applies to the Statement of Project Objectives. If it is existing equipment, and the value of its contribution to the project budget is being shown as cost share, provide logical support for the estimated value shown. If it is new equipment which will retain a useful life upon completion of the project, provide logical support for the estimated value shown.

For equipment over $50,000 in price, also include a copy of the associated vendor quote or catalog price list.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1					
EXAMPLE ONLY!!! Thermal shock chamber	2	$20,000	$40,000	Vendor Quote	Reliability testing of PV modules- Task 4.3
	0		$0		
	0		$0		
	0		$0		
	0		$0		
	0		$0		
	0		$0		
	0		$0		
Budget Period 1 Total			$0		
Budget Period 2					
	0		$0		
Lab equipment - see attached detail sheet		REDACTED		Vendor quotes/Catalogs/actual	Required for a functioning lab - Tasks 2.3,
Office equipment and set-up - see attached detail		EXEMPTION 4		internet or historic actual	Basic office needs
	0		$0		
	0		$0		
	0		$0		
Budget Period 2 Total			$		
Budget Period 3					
	0		$0		

Equipment Item	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
	0		$0		
	0		$0		
	0		$0		
	0		$0		
Budget Period 3 Total			$0		
PROJECT TOTAL			$		

REDACTED
EXEMPTION 4

Additional Explanations/Comments (as necessary)

At the end of this file there are 2 tabs, one for Lab equipment the other for Office equipment which details the above amounts by item. Basis for quotes include vendor quotes, known actual and catalogs.

e. Supplies

PLEASE READ!!!

Supplies are generally defined as an item with an acquisition cost of $5,000 or less and a useful life expectancy of less than one year. Supplies are generally consumed during the project performance. Further definitions can be found at 10 CFR 600 found on the PMC Recipient Resources Forms page at https://www.eere-pmc.energy.gov/Forms.aspx#regs.

List all proposed supplies below, providing a bases of cost such as vendor quotes, catalog prices, prior invoices, etc., and briefly justifying the need for the Supplies as they apply to the Statement of Project Objectives. Note that Supply items must be direct costs to the project at this budget category, and not duplicative of supply costs included in the indirect pool that is the basis of the indirect rate applied for this project.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Budget Period 1					
EXAMPLE ONLY!!! Wireless DAS components	10	$360.00	$3,600	Catalog price	For Alpha prototype - Task 2.4
	0		$0		
	0		$0		
	0		$0		
Budget Period 1 Total			**$0**		
Budget Period 2					
	0		$0		
	0		$0		
	0		$0		
	0		$0		
Budget Period 2 Total			$0		
Budget Period 3					
	0		$0		

General Category of Supplies	Qty	Unit Cost	Total Cost	Basis of Cost	Justification of need
Analytical supplies	0				Required in the normal course of running a laboratory and biorefinery
Chemicals, solvents, polymers	0				Required in the normal course of running a laboratory and
Disposable lab supplies (e.g. gloves)	0				Required in the normal course of running a laboratory and
Safety supplies	0				Required in the normal course of running a laboratory and
Minor engineering equipment	0		REDACTED EXEMPTION 4		Required in the normal course of running a laboratory and
	0				
	0				
	0				
	0				
	0				
Budget Period 3 Total					
PROJECT TOTAL					

Additional Explanations/Comments (as necessary)

The above was based on our historic usage and cost rates. These supplies are required in the normal course of running a biorefinery and for lab analysis and monitoring.

f. Contractual

Sub-Recipient Name/Organization	Purpose/Tasks in SOPO	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
EXAMPLE ONLY!!! XYZ Corp.	Partner to develop optimal fresnel lens for Gen 2 product - Task 2.4	$48,000	$32,000	$16,000	$96,000
Georgia Tech					
MTR - Membrane Technology and Research, Inc.					
The Dow Chemical Company					
					$0
	Sub-total				

REDACTED
EXEMPTION 4

Vendor Name/Organization	Product or Service, Purpose/Need and Basis of Cost (Provide additional support at bottom of page as needed)	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
EXAMPLE ONLY!!! ABC Corp.	Vendor for developing custom robotics to perform lens inspection, alignment, and placement (Task 4.) Required for expanding CPV	$32,900	$86,500		$119,400
					$0

REDACTED
EXEMPTION 4

Sub-Recipient Name/Organization	Purpose/Tasks in SOPO	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
TBD					
					$0
					$0
					$0

REDACTED
EXEMPTION 4

f. Contractual

Sub-Recipient Name/Organization	Purpose/Tasks in SOPO	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
FFRDC Name/Organization	Purpose	Budget Period 1 Costs	Budget Period 2 Costs	Budget Period 3 Costs	Project Total
					$0
NREL- National Renewable Energy Laboratory	REDACTED EXEMPTION 4				
		$	$	$	$
Total Contractual		$	$	$	$

AdditionalExplanations/Comments (as necessary)

The TBD vendors are related to the building and equipping of the pilot-scale integrated biorefinery. Estimates were based on known actual, (potential) vendor quotes as well as our industry knowledge. Detailed sheets which directly correspond to a TBD line item are attached at the end of this file. (For ease of use the tabs are named according to the line item.

g. Construction

PLEASE READ!!!

Construction, for the purpose of budgeting, is defined as all types of work done on a particular building, including erecting, altering, or remodeling. Construction conducted by the award recipient is entered on this page. Any construction work that is performed by a vendor or subrecipient to the award recipient should be entered under f. Contractual.

List all proposed construction below, providing a basis of cost such as engineering estimates, prior construction, etc., and briefly justify its need as it applies to the Statement of Project Objectives.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Overall description of construction actiivities:

Example Only!!! - Build wind turbine platform

General Description	Cost	Basis of Cost	Justification of need
Budget Period 1			
Three days of excavation for platform site EXAMPLE ONLY!!!	$28,000	Engineering estimate	Site must be prepared for construction of platform.
Budget Period 1 Total	**$0**		
Budget Period 2			
Budget Period 2 Total	$0		

General Description	Cost	Basis of Cost	Justification of need
Budget Period 3			
Budget Period 3 Total	$0		
PROJECT TOTAL	**$0**		

Additional Explanations/Comments (as necessary)

Construction will be sub-contracted, one of our sub-recipient partners, The Dow Chemical Company, will provide ground clearing/ land prep work while the actual construction contractor is TBD. These amounts have been included on the Contractual tab. At the end of the this file there is a tab, Construct Recon, which summarizes the the capitalized costs.

h. Other Direct Costs

PLEASE READ!!!

Other direct costs are direct cost items required for the project which do not fit clearly into other categories, and are not included in the indirect pool for which the indirect rate is being applied to this project. Examples are meeting costs, postage, couriers or express mail, telephone/fax costs, printing costs, etc.

Basis of cost are items such as vendor quotes, prior purchases of similar or like items, published price list, etc.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

General description	Cost	Basis of Cost	Justification of need
Budget Period 1			
EXAMPLE ONLY!!! Grad student tuition	$16,000	Established UCD costs	Support of graduate students working on project
Budget Period 1 Total			
Budget Period 2			
REDACTED EXEMPTION 4			
Budget Period 2 Total			

General description	Cost	Basis of Cost	Justification of need
		Budget Period 3	
		REDACTED EXEMPTION 4	
	$0		
Budget Period 3 Total	$		
PROJECT TOTAL	$		

Additional Explanations/Comments (as necessary)

i. Indirect Costs

	Budget Period 1	Budget Period 2	Budget Period 3	Total
Rate applied:		REDACTED		
Total indirect costs requested:		EXEMPTION 4		

A federally approved indirect rate agreement, or rate proposed supported and agreed upon by DOE for estimating purposes is required if reimbursement of fringe benfits is requested. Please check (X) one of the options below and provide the requested information if it has not already been provided as requested, or has changed. Calculate the indirect rate dollars and enter the total in the Section B., line 6.j. (Indirect Charges) of form SF 424A.

____ **There is a federally approved indirect rate agreement. A copy is provided with this application and will be provided electronically to the Contracting Officer for this project.**
(When this option is selected, a presentation of the budget that demonstrates the application of the approved rate, to arrive at the proposed indirect charges proposed should also be provided.)

X **There is no current, federally-approved indirect rate agreement.**
(When this option is checked, the entity preparing this form shall submit an indirect cost rate proposal in the format provided at the following website, or in a format that provides the same level of information and which supports the rate(s) being proposed for use in estimating the project. Go to https://www.eere-pmc.energy.gov/forms.aspx and select PMC 400.2 Sample Rate Proposal.)

Additional Explanations/Comments (as necessary)

Please see the Indirect Proposal tab at the end of this file for indirects calculation. The allowable rate per the calculation is % and we request this rate during Phase II since we anticipate during the construction period this would require maximum overhead effort. Please note the overhead rate was not applied to Fringe, Travel nor construction costs.

Cost Share

PLEASE READ!!!

A detailed presentation of the cash or cash value of all cost share proposed for the project must be provided in the table below. Identify the source & amount of each item of cost share proposed by the award recipient and each sub-recipient or vendor. Letters of committment must be submitted for all third party cost share (other than award recipient).

Note that "cost-share" is not limited to cash investment. Other items that may be assigned value in a budget as incurred as part of the project budget and necessary to performance of the project, may be considered as cost share, such as: contribution of services or property; donated, purchased or existing equipment; buildings or land; donated, purchased or existing supplies; and/or unrecovered personnel, fringe benefits and indirect costs, etc. For each cost share contribution identified as other than cash, identify the item and describe how the value of the cost share contribution was calculated.

Funds from other Federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC sub-recipients. Non-Federal sources include private, state or local Government, or any source not originally derived from Federal funds. Documentation of cost sharing commitments must be provided, if not already provided with the original application and they have not changed since its submission.

Fee or profit will not be paid to the award recipients or subrecipients of financial assistance awards. Additionally, foregone fee or profit by the applicant shall not be considered cost sharing under any resulting award. Reimbursement of actual costs will only include those costs that are allowable and allocable to the project as determined in accordance with the applicable cost principles prescribed in 10 CFR 600.127, 10 CFR 600.222 or 10 CFR 600.317. Also see 10 CFR 600.318 relative to profit or fee.

Add rows as needed. If rows are added, formulas/calculations may need to be adjusted by the preparer.

Organization/Source	Type (cash or other)	Cost Share Item	Budget Period 1 Cost Share	Budget Period 2 Cost Share	Budget Period 3 Cost Share	Total Project Cost Share
ABC Company **EXAMPLE ONLY!!!**	Cash	Project partner ABC Company will provide 40 PV modules for product development at 50% off the of the retail price of $680	$13,600			$13,600
Algenol Biofuels Inc						
The Dow Chemical Company						
The Dow Chemical Company						
Membrabe Technology and Research, Inc.						
						$0
						$0
						$0
						$0
						$0

REDACTED
EXEMPTION 4

Organization/Source	Type (cash or other)	Cost Share Item	Budget Period 1 Cost Share	Budget Period 2 Cost Share	Budget Period 3 Cost Share	Total Project Cost Share
						$0
		Totals	REDACTED EXEMPTION 4			

Total Project Cost: $

Cost Share Percent of Award:

Additional Explanations/Comments (as necessary)

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Exemption 4

The Dow Chemical Company
Midland, Michigan 48674

June 16, 2009

Dr. Craig R. Smith
Chief Operating Officer
Algenol Biofuels Inc.
28100 Bonita Grande Drive, Suite 200
Bonita Springs, Florida 34135

Dear Dr. Smith:

The Dow Chemical Company (Dow), with annual sales of $58 billion and 46,000 employees worldwide, is a diversified chemical company that combines the power of science and technology with the "Human Element" to constantly improve what is essential to human progress. Dow delivers a broad range of products and services to customers in around 160 countries, connecting chemistry and innovation with the principles of sustainability to help provide everything from fresh water, food and pharmaceuticals to paints, packaging and personal care products.

Dow confirms its proposal to cooperate with Algenol Biofuels, Inc. (Algenol), by

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EXEMPTION 4

per year. Dow would be pleased for the opportunity to be able to work closely with Algenol, Principle Investigator, as described in the proposal entitled "Demonstration of Pilot-Scale Integrated Biorefinery Operations for Producing Ethanol from Algae" submitted to the US Department of Energy in response to the Funding Opportunity Announcement DE-FOA-0000096.

This project complements Dow's efforts in Sustainable Chemistry as stated in our publicly announced 2015 goals and is supported by our Polyethylene and Hydrocarbon and Energy Businesses. Steven Gluck, one of Dow's top experts in analytical chemistry, water treatment and algae technology, will lead the Dow effort.

Dow has dedicated significant resources in research for both alternative energy and minimizing the carbon footprint of manufacturing. Recent announcements include: a projected commercial launch of Building Integrated Photovoltaics for the home (The development of this technology is supported in part by a cooperative agreement with the US Department of Energy Solar America Initiative), an agreement with Alstom to build a pilot facility in West Virginia to capture CO_2 from a coal fired power plant, a joint project with NREL to focus on improving mixed alcohol catalysts for producing ethanol and AIRSTONE™ Systems for Wind Energy. Dow currently is expanding the products

made from renewable resources including RENUVA™ renewable resource technology polyols and the first integrated sugarcane derived ethanol to polyethylene world scale commodity production facility. In addition, Dow has proposed a comprehensive national energy security plan that stresses greater conservation, more use of domestic energy sources, development of natural gas and nuclear power and accelerated development of alternative energy with a reduction in greenhouse gases.

Dow proposes to support this program by providing

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EXEMPTION 4

Dow's participation in this collaboration would be, of course, pursuant to finalization and execution of relevant written contracts or subcontracts governing such collaboration that are acceptable to Dow. The finalization and execution of any such contracts and subcontracts shall be at Dow's sole discretion, and is subject to approval by requisite management or executive leadership.

We look forward to the opportunity to further advance our collaboration with Algenol.

Sincerely,

William F. Banholzer
Executive Vice President and Chief Technology Officer

MTR Membrane Technology & Research

May 5, 2009

Algenol Biofuels Inc.
Craig R. Smith, M.D.
Executive Vice President, Chief Operating Officer
28100 Bonita Grande Drive, Suite 200
Bonita Springs FL 34135

Re: Commitment Letter: "Pilot-Scale Integrated Biorefinery Operations for Producing Ethanol From Algae"

Dear Dr. Smith,

The purpose of this letter is to confirm our support for and participation in the project **"Pilot-Scale Integrated Biorefinery Operations for Producing Ethanol From Algae,"** which will be submitted as a proposal to the US Department of Energy under Funding Opportunity DE-PS36-09GO99038.

REDACTED
EXEMPTION 4

We look forward to working with you and the distinguished team that Algenol has assembled to successfully complete the goals of this project and prepare the technology for commercialization.

Sincerely,

Richard W. Baker, Ph.D.
Principal Scientist
Membrane Technology and Research, Inc.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF RESEARCH AND DEVELOPMENT
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
CINCINNATI, OHIO 45268

April 23, 2009

Craig R. Smith, M.D.
Executive Vice President, Chief Operating Officer
Algenol Biofuels, Inc.

Dr. Wood,

The purpose of this letter is to indicate our interest in supporting the project "**Demonstration of Pilot-Scale Integrated Biorefinery Operations for Producing Ethanol From Algae**" submitted as a proposal to the U.S. Department of Energy under Funding Opportunity DE-PS36-09GO99038 - Demonstration of Integrated Biorefinery Operations. As you know, the U.S. Environmental Protection Agency's National Risk Management Research Laboratory (USEPA-NRMRL) has an active in-house research program in the conversion of biomass to alcohol-based biofuels with an emphasis on the efficient recovery of the alcohols from dilute bioreactor media and the dehydration of the alcohols to meet product specifications. We believe our background in efficient alcohol-water separation systems will help the Algenol-led team successfully develop their algae-based ethanol production platform.

Our separations research group has a long history of supporting biofuels projects, including collaborating with industrial partners on projects funded by the U.S. Department of Agriculture, U.S. Army, and the U.S. Department of Energy. We are currently collaborating through a cooperative research and development agreement (CRADA) with a membrane separation company and member of your project team, Membrane Technology and Research, Inc. (MTR), to develop highly efficient membrane-based and hybrid distillation-membrane processes for recovery of biofuel alcohols from dilute fermentation broths. During the proposed project, we will provide technical support and facilities to the Algenol-led team that will enable: the identification and implementation of efficient separation processes; the evaluation of such separation processes in our facilities or other project locations; access to our extensive know-how related to design and performance of membrane-based and other innovative separation processes; and the identification of scale-up and life cycle issues related to the algae-based process.

In order to assist your efforts, we are prepared to obligate

REDACTED
EXEMPTION 4

We look forward to the opportunity to partner with Algenol and the other collaborators on this project.

Sincerely,

Douglas Young

Douglas Young, Ph.D.
Chief, Clean Processes Branch
Sustainable Technology Division

Environmental Questionnaire for FOA Applicants

PART I: General Information

Applicant Name:	***Algenol Biofuels Inc.***
Proposed Project Title:	***Pilot-Scale Integrated Biorefinery Operations for Producing Ethanol From Hybrid Algae***
Solicitation Number:	***DE-FOA-0000096***
Applicant Preparer:	***Dr. Craig Smith***
Applicant Phone:	***(239) 498-2000***
Applicant Email:	***craig.smith@algenolbiofuels.com***

1. Please describe the intended use of DOE funding in your proposed project. For example, would the funding be applied to the entire project or only support a phase of the project? Describe the activity as specifically as possible, i.e. planning, feasibility study, design, data analysis, education or outreach activities, construction, capital purchase and/or equipment installation or modification.

Algenol Biofuels Response: *Algenol intends to use the DOE funds for this entire pilot-scale integrated biorefinery project, subject to the cost share amounts to be borne by the applicant and its collaborators.*

Algenol today possesses the most advanced third generation biofuel technology in the United States. Algenol makes low cost ethanol directly from CO_2 and seawater using hybrid algae in sealed, clear plastic photobioreactors through its unique, patented Direct to Ethanol™ technology – all powered by the sun. Importantly, this is done without processing or transporting a separate biomass. At its core, Algenol has several components that come together in an integrated biorefinery from upstream CO_2 to final fuel grade ethanol product.

Algenol brings to this project significant capabilities and experience of its own and, together with its world-class partners, seeks to accelerate the commercialization of its Direct to Ethanol™ technology through application for funding by the Department of Energy.

Algenol's technology has culminated in hybrid algae that produce over 6,000 gallons of ethanol per acre per year, compared to corn at 400. Algenol's process achieves an energy balance of over 5 to 1 and a Life Cycle Carbon Analysis in a practical case that demonstrates that Algenol's Direct to Ethanol™ production process has a carbon footprint that is merely 20% of petroleum (an 80% reduction from petroleum). Algenol intends to build commercial scale facilities that can produce ethanol for under $1.50 per gallon. Our group of people, companies, and institutions are extraordinarily talented and possess diverse skills that ensure Algenol can not only execute on its plan to build both this pilot-scale integrated biorefinery, but Algenol will bring the technology to commercial scale in under 5 years.

Algenol, since its inception in 2006, rapidly advanced technology based on work done by one of the founders from 1984 through 1996.

- *Algenol has gone from its first hybrid algae cell, to over 300 hybrid algae cell lines;*
- *From 50ml scale to over 150 photobioreactors each with 300-liters;*
- *Algenol has designed and built 4,500-liter commercial scale flexible film photobioreactors;*
- *Algenol has increased hybrid algae ethanol synthesis over 200 times from the original work; and*
- *Higher ethanol production per square meter leads to lower cost and greater efficiency.*

The algae take in sunlight, grow in saltwater in sealed, clear plastic photobioreactors, carbon dioxide is introduced, each cell produces and excretes ethanol into the culture, and that ethanol evaporates into the headspace for collection and purification. Algenol can do this on marginal land, and without collecting, harvesting and killing the algae. The cultures live for over a year and channel carbon directly into ethanol production.

Significant economic and energy advantages are gained with collecting an evaporative product, and producing a single molecule that is always the same ethanol molecule. It requires separation from water, but no further refining into a homogenous, fuel ready product. Significant infrastructure already exists in the U.S. to blend ethanol. Ethanol has been maligned in the press lately when connected to corn, but ethanol is not the problem. When made cheaply enough and not from food, consumers have shown that they readily accept it in automobiles.

Algenol started with $70 million in equity funds from its 4 founders. The founders include:

- *a public company biotech pharmaceutical executive who founded and built a successful drug company with 350 employees and $50 million in sales;*
- *a second public company biotech executive that formed and launched a commercial contract manufacturing company that provides biopharmaceutical companies manufacturing services to scale-up from bench-top scale to commercial scale production compliant with US FDA Good Manufacturing Practices regulations;*
- *an energy company founder who built from his garage a $100 million public company, and a $70 million private energy company with over 800 employees in 6 states operating 4 natural gas pipelines and storage facilities, and complex natural gas hedging and risk management; and*
- *one of the four executives who control and operate the Corona beer company, including Grupo Modelo's packaging and paper products division.*

Algenol's strength is not just centered on its financial strength, but on it people, including:

- *the people who invented the technology in 1984 and developed the technology to proof of principle in 1998;*
- *the other inventors that have sought patents in algae to ethanol;*
- *the people heading the leading blue-green algae natural products company with 15 years experience;*
- *the people heading one of the largest commercial algae growers in Europe with 10 years experience;*
- *a former ExxonMobil executive and expert in CO2 capture systems, whose work included the direction of over 150 scientists and engineers in a major division of ExxonMobil Chemical;*
- *VeraSun Energy's former General Counsel and EH&S manager;*
- *Amgen's former Senior Project Manager, charged with scale up to commercial launch;*
- *Unilever's former VP General Manager;*
- *2 national academy members;*
- *a very strong Scientific Advisory Board; and*
- *many leading scientists and engineers all contributing to the foundation of Algenol, which has now become 100 of the most dedicated leaders in algae biofuels in the world.*

Algenol has brought together world-class partners with significant capabilities of their own and these capabilities bring many competitive advantages to Algenol and the overall Direct to Ethanol™ technology. The Dow Chemical Company, Georgia Tech, the National Renewable Energy Laboratory and Membrane Technology & Research (MTR) are all a part of Algenol's application.

The Dow Chemical Company will provide support from three of its businesses, namely the Polyethylene,

Hydrocarbon, and Energy businesses. Dow brings significant expertise in advanced polymer science directly impacting the cost, functionality, and durability of our photobioreactors. Dow will be providing
Exemption 4

Steven Gluck, Ph.D., one of Dow's top experts in analytical chemistry, water treatment and algae technology, will lead the Dow effort.

Georgia Tech and MTR will provide expertise in several key areas to the advanced commercialization of the Direct to Ethanol™ technology. Georgia Tech will conduct research aimed at a broad spectrum of technology improvements, all of which bear directly or indirectly on the reduction of ethanol production costs. The work divides into four areas:
Exemption 4

Bill Koros, Ph.D., and Chris Jones, Ph.D., lead this initiative at Georgia Tech. Richard Baker, Ph.D., will lead the initiative for MTR.

While we have an ethanol water separation process that works and is economical today, we believe that we can significantly improve the efficiency and reduce energy expenditure through further advanced research in this area. Water separation from ethanol presently represents 80% of our non-solar energy input. Clearly, it is a major opportunity for reduction in production costs, and this is a big advantage for Algenol both in terms of cost and energy savings, but also in terms of carbon footprint savings. The proposed research into advanced ethanol-water separation systems will have three main components.
Exemption 4

**More than $30 million dollars has been spent on R&D to date by Algenol. Algenol's application to the DOE is not centered on future research. Although this application does contemplate targeted R&D up to the maximum 10%, nearly three million dollars of the total budget, all of the R&D done through the end of 2009 will be done with Algenol's capital.*

Clearly, this application is centered on advancing the compelling R&D and scale up that has been completed to date by Algenol. The funds from the DOE will bring this advanced algae ethanol biofuel technology out of the large scale, and propel it into commercial-scale in an integrated way.

Algenol photobioreactors and process design parameters achieve cost reduction in the three primary areas: material and structure, energy required for mixing, and product harvest expense. Through thermodynamic processes and assisted by culture mixing, ethanol evaporates into the photobioreactor's headspace and subsequently it condenses on the upper inside surface of the same photobioreactor's headspace and is enriched over the ethanol concentration in the culture. To take advantage of this Algenol has developed from scratch three generations of photobioreactors. Each was built and tested and scaled to culminate in a very low cost commercial-scale flexible film photobioreactor system at 4,500 liter each. Algenol's plastics experts, with over 150 years experience, and Dow's advanced material group, will do final designs and specs for the Freeport, Texas pilot-scale integrated biorefinery.

Algenol has built the largest collection of blue-green algae in the world, built from scratch two separate research and development labs with over 60 scientists working on many projects including a rapid screening lab and proprietary screening paradigm, built a separate engineering lab with significant engineering capability, built rapid outdoor algae screening capabilities at two separate facilities, and built a licensed aquaculture facility and Process Development Unit in Florida, all within 3 years. Algenol will employ thousands of people in the future, and many at very high wages.

Algenol has detailed conceptual blueprints completed for the pilot-scale integrated biorefinery on Dow's land in Freeport Texas. Algenol has completed detailed engineering work as well. In our application we allow Exemption 4

Algenol has already demonstrated its ability to attract the very best talent, execute on its plan, and scale up working systems, all of these lead to a successful pilot-scale integrated biorefinery and ensures that the DOE's accomplishes its goal as well.

2. Does any part of your project require review and/or permitting by any other federal, state, regional, local, environmental, or regulatory agency? If yes, please describe.

Algenol Biofuels Response: *Yes.*

Federal regulation:

Hybrid Algae: *Under the 1986 Coordinated Framework for Regulation of Biotechnology, either the U.S. Department of Agriculture (USDA) or the U.S. Environmental Protection Agency (EPA) would be responsible for regulating the use and management of our hybrid algae. Presently, we anticipate that the EPA will exercise its authority under the Toxic Substances Control Act (TSCA) to regulate our hybrid algae under 40 CFR Part 725 as microbial products of biotechnology.*

Based upon direct discussions with EPA staff and advice of counsel, we do not anticipate EPA imposing regulatory restrictions that would impair our ability to proceed with this project as planned. In part, this is because every stage of Algenol's development, use, transportation and disposal of hybrid algae will take place in contained facilities or vessels, consistent with EPA's TSCA regulations.

Initial laboratory scale research and development takes place at Algenol's research laboratory in Baltimore, MD. The largest individual cultures used in the Baltimore lab are in the order of 80L. All Baltimore research takes place inside the laboratory in hard reactors within environmental chambers.

At present, Algenol has over 300 strains of ethanol producing algae. It must be said that Algenol does not believe that any component, together or separately, are in any way dangerous. The genes and enzymes over expressed and produced in the hybrid algae are very widely found in nature and in many of the foods you eat every day. Almost every handful of surface soil in most areas of the temperate planet would contain cyanobacteria of some sort, and many have these genes and or the ability to make ethanol naturally. Foods that would have been made with these genes and enzymes are all regular bread, all beer and all wine. Also these same genes and enzymes are found on the store-shelf of every grocery store in America in packets of yeast used for making bread. Algenol has not used synthetic biology to make synthetic genes or proteins that have never existed before. Blue-green algae are in most areas of the planet, and the genes and natural enzymes that Algenol uses Exemption 4 *Algenol works with very commonly found enzymes that are very safe, yet we understand that until time has passed, and everyone has had time to see how safe these hybrid algae are, we take extraordinary steps and actions used during the handling of much more dangerous material in a belt and suspenders approach to safety. We want everyone to see in the end that these algae are incredible simple, like yeast, but also incredibly safe.*

Exemption 4

Exemption 4

**In light of the above, when handling hybrid algae, scientists wear disposable gloves and goggles as necessary inside any laboratory. The organisms are killed with bleach following experiments and any materials that come into contact with such organisms are either autoclaved or cleaned with bleach or 70% ethanol solution and are then properly disposed of. The biomass is removed from the laboratory on a regularly scheduled basis by an authorized contractor specializing in waste transportation.*

When a strain of hybrid algae is approved for larger scale production, a very small, laboratory-scale, volume of the strain (cells maintained on agar slants as stocks) will be transferred from the Baltimore laboratory to the laboratory at the Texas pilot project facility. This transfer will be under contained conditions in order to minimize risk of environmental release. Moreover, such transfers are anticipated to occur rarely. Ideally, such a transfer would occur once and all future hybrid algae would be grown from the transferred stock at the Texas facility.

Once in the Texas laboratory, the algae will be placed in a liquid culture and scaled up from the level of Petri dish, to flask, to larger containers within a greenhouse. Exemption 4 *. This phased scale up approach is a necessary component of successful production of these algae. It is unlikely that they will survive a direct transfer from a small container in which their mass makes up the volume of the container to a far larger container in open sunlight. This natural limitation provides an inherent protection against unintended survival in the environment. An even greater assurance against such unintended survival is the fact that the hybrid algae are unable to compete and survive or reproduce outside the saltwater culture medium in the photobioreactor. This photobioreactor maintains optimum conditions for their survival not found in nature.*

**From the greenhouse, the algae will be transferred to enclosed, sealed photobioreactors, as described more fully in the Project Execution Plan and elsewhere.* Exemption 4

**We also take multiple, redundant steps to prevent any escape from containment of the algae during any stage of processing.* Exemption 4

. In sum, Algenol has taken reasonable measures to ensure that the hybrid algae will be used only inside the constraints of physical confinement similar to those that are found in a laboratory, greenhouse, or other contained structure.

Algenol has met with the EPA Chemicals Branch personnel to explain in detail our proposed project to demonstrate our DIRECT TO ETHANOL™ process for biofuel production. Following our meeting with the EPA, we are now preparing to submit the appropriate information to the EPA in order to facilitate that agency's review and approval of any necessary clearances under TSCA. We anticipate that EPA review of our submittal will be concluded before applicants under this funding opportunity are selected for grants. Regardless of the results, Algenol will share EPA's final review document with all appropriate DOE officials as soon as it is available. Algenol is prepared to, and will, comply with all regulatory requirements set out by EPA under TSCA, including any additional containment, handling or disposal requirements.

**Under the distribution of regulatory authority laid out in the Coordinated Framework, we do not believe that we would be subject to regulation by USDA. At USDA, the Animal and Plant Health Inspection Service (APHIS), regulates certain microorganisms under the Plant Protection Act. These regulations are found at 7 CFR Part 340. APHIS regulates organisms altered or produced by genetic engineering if APHIS has reason to believe the organism is a "plant pest." Pursuant to those regulations, Algenol has submitted a letter to APHIS providing a detailed identification of the hybrid algae that we use to produce ethanol fuel, as well as our analysis of the relevant regulations. The letter concludes by stating that the hybrid algae used by Algenol are not identified plant pests as defined by APHIS and do not have characteristics similar to plant pests. We understand from conversations with APHIS officials that APHIS and EPA are currently in discussions to determine their respective jurisdiction over Algenol's hybrid algae. Of course, if EPA and APHIS determine that APHIS is the appropriate federal regulator of our hybrid algae, Algenol will comply with all appropriate APHIS regulatory requirements, including those regarding the permitting of interstate movement. Due to the contained nature and operation of the photobioreactors, we do not anticipate the need for an APHIS environmental release permit.*

***Air:** As a minor source, the projected facility will not require federal new source review. We do not anticipate EPA or the Texas Commission on Environmental Quality imposing regulatory burdens that outweigh the value of developing the project since Algenol's process does not place human health or the environment at risk. On the contrary, biofuel production by Algenol at the pilot-scale project proposed in this funding application, and at any follow-on commercial scale facilities, will actually benefit human health and the environment by displacing less preferred fuels. Algenol's biofuel will contribute less net greenhouse gas emissions than any conventional transportation fuel and less than many other advanced technology biofuels. Carbon dioxide, the only greenhouse gas emitted from combustion of fuel produced using DIRECT TO ETHANOL™ technology, is entirely derived from captured industrial sources or, potentially, from the ambient air. None of it is added to the atmosphere from fossil fuel combustion. Minimal amounts of ethanol vapor and carbon dioxide will be released, and all water will be purified before release under the terms of an existing state water permit.*

***Water:** There is an existing water permit for the Dow site, the federal rules will be addressed through the permit. The current site under consideration is described as "undeveloped" and Dow would need to describe this unit description under the appropriate permit discharge outfall.*

Before any earthwork can be done, the land involved needs to be determined to not contain jurisdictional wetlands. The particular area involved does not likely contain jurisdictional wetland but it will need to be confirmed. Dow Chemical has several alternative locations at its Freeport facility in the event of