FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U.S. Department of Energy
Golden Field Office

Biomass Fast Pyrolysis Oil (Bio-oil) Stabilization

Funding Opportunity Announcement Number: DE-PS36-08GO98018

Announcement Type: Initial

CFDA Number: 81.087 Renewable Energy Research and Development

Issue Date: **April 16, 2008**

Application Due Date: **May 29, 2008 11:59 PM Eastern Time**

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PART I – FUNDING OPPORTUNITY DESCRIPTION

The U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, (EERE) announces a notice of availability of funds for financial assistance addressing the development of technology capable of stabilizing biomass fast pyrolysis oil (a.k.a. bio-oil or flash pyrolysis oil). This Funding Opportunity Announcement (FOA) is authorized under Sec. 932 of the Energy Policy Act of 2005.

This FOA is seeking applications offering practical, cost effective methods for stabilizing biomass fast pyrolysis oil. For purposes of this FOA, stabilization means a reduction of oxygen content within the various organic compounds collectively comprising pyrolysis oil, with a preference toward rejecting the oxygen as an economically optimum balance between carbon oxides and water. A further preference is to remove oxygen present as carboxylic acid groups such that the total acid number (TAN)[1] of the pyrolysis oil is dramatically reduced, preferably below 5. It is also known that the presence of alkali metals, sequestered in char particles, catalyzes the reaction between various organic compounds present in pyrolysis oil, leading to higher viscosities. Therefore, combining methods to include reduction of char content within the pyrolysis oil is also a desired outcome of this FOA. The ideal target for char content would be zero but it is recognized that this is probably not practical. However, because of the limitation of cyclone separators to effectively remove particles below 3 microns, an approach only using cyclones will be considered non-responsive to this FOA. Successful applicants will be required to demonstrate the efficacy of their respective stabilization methods by exposing the stabilized pyrolysis oil to accelerated aging studies, followed by measurement of the rate of increase in viscosity (as low as possible) compared against a non-stabilized pyrolysis oil control sample. Details on this accelerated aging study and viscosity measurement are provided in Appendix D. TAN and oxygen content will also be compared against the control sample.

Under appropriate pyrolysis operating conditions, biomass can be converted to relatively high yields (~70 wt %) of liquids – a mixture of organic compounds (pyrolysis oil) and water. The liquid organics are oxygenated hydrocarbon compounds resulting from the thermal breakdown of lignin, cellulose, and hemicellulose. Collectively, pyrolysis oil is comprised of a complex mixture of acids, alcohols, aldehydes, esters, ketones, sugars, phenols, furans, and multifunctional compounds such as hydroxyacetaldehyde. The relative amounts of each compound class can vary depending on the biomass feedstock used and the operating conditions employed during pyrolysis. High pressure (hydrothermal) liquefaction is another approach to converting biomass to liquids. However, this approach is not of interest under this FOA, liquids produced using this technique do not qualify as "pyrolysis oil" liquids and applications proposing them will be considered non-responsive to this FOA.

Recent research supported by DOE has shown promise in upgrading these oxygenated compounds to fungible hydrocarbon fuels, such as gasoline and diesel, by employing conventional petroleum refining techniques, such as hydrotreating and hydrocracking. It is not

[1] The Total Acid Number (TAN) is the amount of potassium hydroxide in milligrams that is needed to neutralize the acids in one gram of oil as described in ASTM D664-81.

the intention of this FOA to include this final upgrading step, rather only to address the problem of producing a stable intermediate product. Although this is a promising path to production of alternate fuels from biomass, the as-produced pyrolysis oil has long term storage stability issues that need to be addressed for this technology to be commercially viable. The specific issues relate to the characteristic of the pyrolysis oil viscosity to increase over time during storage.

The rate of viscosity change is also exacerbated at elevated storage temperatures and can, under extreme conditions, result in the pyrolysis oil becoming a solid. Another characteristic of pyrolysis oil is the fact that it is comprised of a large number of oxygenated organic compounds many of which are organic acids (acetic and formic). Consequently, the pyrolysis oils have a relatively high TAN that require storage vessels and processing equipment to be fabricated from expensive corrosion resistant alloys. Another compounding characteristic of pyrolysis oil is the presence of char particles in the condensed product, normally as a result of the thermal processing when cyclones are used to separate particles from the vapor stream.

During pyrolysis, the mineral matter present in the biomass feed ends up being sequestered in the char. Studies have shown this mineral matter to be uniformly distributed throughout the char particle including the surface. Prior research has also linked the presence of this char, and more importantly the mineral content, as potential catalysts for reactions between the various chemical compounds making up pyrolysis oil. These characteristics present practical problems in the storage, transport, and processing of pyrolysis oils prior to and during their upgrading to hydrocarbon fuels. It is desirable to develop technical approaches to producing pyrolysis oil with a stability enabling the resulting pyrolysis oil to be transported and stored, in commercial scale tankage, for at least six months under ambient conditions.

Given the complex mixture of compounds present in pyrolysis oil it is expected that chemical reactions can occur between some of these compounds. Indeed, studies have shown that addition of alcohols under the appropriate conditions can react with acids and aldehydes to form esters and acetals, respectively. These reactions have the desired effect of reducing the carboxyl and carbonyl functional groups and, consequently, the TAN, but it is an expensive and cumbersome approach. Therefore, the addition of alcohols to pyrolysis oil to force reactions with organic acids and aldehydes is NOT an approach desired and/or sought under this FOA, and applications proposing this approach will be considered non-responsive and rejected for consideration.

Conceptually, it is possible to approach the stability problem in two fundamentally different ways. One approach is to try to influence the chemistry of the molecular fragments de-polymerizing from the biomass substrate during the initial pyrolysis step. The other approach is to manipulate the chemistry of the pyrolysis oil post pyrolysis (except as noted above with reaction with alcohols). Either approach, or even a combination of the two, is acceptable within the parameters of this FOA. In both cases, DOE intends to provide starting material, in the form of standard samples of biomass feedstock or pyrolysis oil prepared from the same feedstock, to successful applicants to this FOA. This is being done to ensure that proposed technologies being developed under this FOA can be compared on a common basis. It is recognized that pyrolysis oil made from different feedstocks could possibly have different stability properties and the requirement of having a common biomass feedstock (or pyrolysis oil made from it) is intended to eliminate the influence of this variable.

Successful applicants will be expected to demonstrate the efficacy of their proposed technology to stabilize pyrolysis oil by conducting viscosity measurements of the stabilized pyrolysis oil following storage according to protocols specified in Appendix D. Results from these measurements will be a required part of the final technical report for projects awarded under this FOA.

Building upon established and demonstrated scientific principals, successful applications shall clearly describe the methodology of the proposed technology and its ability to achieve the stated objectives of this FOA. The discussion should include rationale explaining why the proposed technology is practical and cost effective. The intent is to receive applications geared toward applied research and development leading to successful commercial application of the proposed technology. The technical approaches to addressing the pyrolysis oil stability problem are intended to be applicable in both stand-alone as well as distributed processing facilities. Therefore, it is desirable to have technical approaches that are relatively simple and cost effective for both types of applications. To assess the relative cost for a given technical approach, applicants are required to provide preliminary cost estimates measured in dollars per gallon of produced pyrolysis oil. Include assumptions made in determining cost estimates.

Applicants are encouraged to partner with other organizations having capabilities uniquely suited to the objectives of this FOA. Other organizations may be foreign based universities or companies and would be expected to bring pyrolysis oil expertise relevant to the proposed work. The foreign participant would be required to bring cost share to the project but would not be eligible to receive direct funding from DOE.

Funds under this FOA cannot be used for development of biomass fast pyrolysis systems. However, modification of an existing system is permitted provided it is part of the proposed new technical approach. If the applicant does not have biomass pyrolysis capability within its own organization, the applicant is expected to partner with someone who does have this capability.

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT

DOE anticipates awarding grants and/or cooperative agreements under this program announcement. If it is determined that a cooperative agreement is the appropriate award instrument, the nature of the Federal involvement will be included in a special award condition.

B. ESTIMATED FUNDING

Approximately $ 4,000,000 is expected to be available for new awards in FY 2008 and an additional $ 3,000,000 is expected to be available for continued funding of awards made under this announcement in FY 2009.

C. MAXIMUM AND MINIMUM AWARD SIZE

Ceiling (i.e., the maximum amount for an individual award made under this announcement): $1,500,000

Floor (i.e., the minimum amount for an individual award made under this announcement): $400,000

D. EXPECTED NUMBER OF AWARDS

DOE anticipates making 5-7 awards under this announcement depending on the size of the awards.

E. ANTICIPATED AWARD SIZE

While the maximum award size (i.e., the ceiling) is $ 1,500,000, DOE anticipates that awards will be in the $500,000 - $1,500,000 range for the total project period.

F. PERIOD OF PERFORMANCE

DOE anticipates making awards that will run for up to two years.

G. TYPE OF APPLICATION

Only new applications will be accepted under this announcement (e.g., applications for renewals of existing DOE funded projects will not be considered).

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS

All types of entities are eligible to apply, except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995. Foreign participation is permitted, particularly if they bring background experience or capability to the proposed work. The foreign participant would be required to bring cost share to the project, but would not be eligible to receive direct funding from DOE.

B. COST SHARING

Cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law.

C. OTHER ELIGIBILITY REQUIREMENTS

Federally Funded Research and Development Center (FFRDC) Contractors
FFRDC contractors are not eligible for an award under this announcement, but they may be proposed as a team member on another entity's application subject to the following guidelines:

Authorization for non-DOE FFRDCs. The Federal agency sponsoring the FFRDC contractor must authorize in writing the participation of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The participation of a FFRDC contractor must be consistent with the contractor's authority under its award. Save the authorization in a single file named "FFRDC_Auth.pdf," and click on "Add Optional Other Attachment" to attach.

Authorization for DOE FFRDCs. The cognizant contracting officer for the FFRDC must authorize in writing the participation of a DOE FFRDC contractor on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization.

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory, will not adversely impact execution of the DOE assigned programs at the laboratory."

Value/Funding. The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE will fund a DOE FFRDC contractor through the DOE field work proposal system and other FFRDC contractors through an interagency agreement with the sponsoring agency.

Cost Share. The applicant's cost share requirement will be based on the total cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

FFRDC Contractor Effort. The FFRDC contractor effort, in aggregate, shall not exceed 50% of the total estimated cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

Responsibility. The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

D. MULTIPLE PRINCIPAL INVESTIGATORS

The assignment and use of multiple Principal Investigators (PIs) in projects awarded under this FOA is allowed. The applicant, whether a single organization or team/partnership/consortium, must, however, indicate in the application if the project will include multiple PIs. (See Part IV, Section C.) The decision to use multiple PIs for a project is the sole responsibility of the

applicant. If multiple PIs will be designated, the application must identify in the application the Contact PI/Project Coordinator and provide a "Coordination and Management Plan" that describes the organization structure of the project as it pertains to the designation of multiple PIs. This plan should, at a minimum, include:

- Process for making decisions on scientific/technical direction;
- Publications;
- Intellectual property issues;
- Communication plans;
- Procedures for resolving conflicts; and
- PIs' roles and administrative, technical, and scientific responsibilities for the project.

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE

Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select "Apply for Grants," and then select "Download Application Package." Enter the CFDA and/or the funding opportunity number located on the cover of this announcement and then follow the prompts to download the application package. **(Also see Section H of this Part below.)**

B. LETTER OF INTENT AND PRE-APPLICATION

1. **Letter of Intent**
   Letters of Intent are not required.
2. **Pre-application**
   A pre-application is not required.

C. CONTENT AND FORM OF APPLICATION

You must complete the mandatory forms and any applicable optional forms, in accordance with the instructions on the forms and the additional instructions below, as required by this FOA. **Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement**.

SF 424 - Application for Federal Assistance

Complete this form first to populate data in other forms. Complete all required fields in accordance with the pop-up instructions on the form. **To activate the instructions, turn on the "Help Mode" (Icon with the pointer and question mark at the top of the form.)** The list of certifications and assurances referenced in Field 21 can be found at http://management.energy.gov/business_doe/business_forms.htm, under Certifications and Assurances.

Other Attachments Form

Submit the following files with your application and attach them to the Other Attachments Form. Click on "Add Mandatory Other Attachment," to attach the Project Narrative. Click

on “Add Optional Other Attachment,” to attach the other files.

a. Project Summary/Abstract File

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). Applicants are cautioned that this document should not include any proprietary information, trade secrets, or other confidential business, financial or sensitive information, since this summary may be subject to public disclosure under the Freedom of Information Act (FOIA). The project summary must not exceed 1 page when printed using standard 8.5” by 11” paper with 1” margins (top, bottom, left and right) with font not smaller than 11 point. Save this information in a file named “Summary.pdf,” and click on “Add Optional Other Attachment” to attach.

b. Project Narrative File - Mandatory Other Attachment

The project narrative must not exceed 20 pages, including cover page, table of contents, charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5” by 11” paper with 1 inch margins (top, bottom, left, and right). EVALUATORS WILL REVIEW ONLY THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application. See Part VIII.D for instructions on how to mark proprietary application information. Save the information in a single file named “Project.pdf,” and click on “Add Mandatory Other Attachment” to attach.

The project narrative must include:

- Project Objectives:
  This section should provide a clear, concise statement of the specific objectives/aims of the proposed project and an explanation of how they will be carried out.
- Project Timetable:
  This section should outline as a function of time, year by year, all the important activities or phases of the project, including any activities planned beyond the project period. Successful applicants must use this project timetable to report progress.

The above listed components of your Project Narrative combined, must be within the Narrative page limit specified above. Documents listed below may be included as clearly marked appendices to your Narrative and will not count towards the Project Narrative page limit. Please note that some of the required documents listed below may have their own page limits to which you must adhere.

c. Resume File

Provide a resume for each key person proposed, including subawardees and consultants if they meet the definition of key person. A key person is any individual who contributes in a substantive, measurable way to the execution of the project. Save all resumes in a single file named "resume.pdf," and click on "Add Optional Other Attachment" to attach. Each individual resume must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and should include the following information, if applicable:

Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically.

Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than 5 professional and scholarly activities related to the effort proposed.

Of the key personnel identified in this file, indicate the Principal Investigator(s) (PI). If multiple PIs are proposed, the applicant must provide the information indicated in Part III, Section D. as part of this file.

The resume file does not have a page limitation.

d. Budget File

SF 424 A Excel, Budget Information – Non-Construction Programs File

You must provide a separate budget for each year of support requested and accumulative budget for the total project period. Use the SF 424 A Excel, "Budget Information – Non Construction Programs" form on the Applicant and Recipient Page at http://management.energy.gov/business_doe/business_forms.htm. You may request funds under any of the Object Class Categories as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (See PART IV, G). Save the information in a single file named "SF424A.xls," and click on "Add Optional Other Attachment" to attach.

e. Budget Justification File

A Budget Justification for SF 424A must be provided for the costs proposed in each Object Class Category/Cost Classification category (e.g., identify key persons and personnel categories and the estimated costs for each person or category; provide a list of equipment and cost of each item; identify proposed subaward/consultant work and cost of each subaward/consultant; describe purpose of proposed travel, number of travelers and number of travel days; list general categories of supplies and amount for each category; and provide any other information you wish to support your budget). Provide the name of your cognizant/oversight agency, if you have one, and the name and phone number of the individual responsible for negotiating your indirect rates as part of the budget justification or under the comments under the Indirect tab of the Budget Justification form.

The format provided as PMC 123.1, Budget Justification for SF 424A, on the Applicant and Recipient Page at http://management.energy.gov/business_doe/business_forms.htm is recommended but not required for use in providing this budget justification.

f. Subaward Budget File(s)

You must provide a separate budget (i.e., budget for each budget year and a cumulative budget) for each subawardee that is expected to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less). Use the SF 424 A Excel for Non Construction Programs or the SF 424 C Excel for Construction Programs. These forms are found on the Applicant and Recipient Page at http://management.energy.gov/business_doe/business_forms.htm. Save each Subaward budget in a separate file. Use up to 10 letters of the subawardee's name (plus .xls) as the file name (e.g., ucla.xls or energyres.xls), and click on "Add Optional Other Attachment" to attach.

A budget justification for the subaward budget is also required. If the SF 424A budget format is used for the application, the format provided as PMC 123.1, Budget Justification for SF 424A, on the Applicant and Recipient Page at http://management.energy.gov/business_doe/business_forms.htm is recommended but not required for use in providing this budget justification.

g. Letters of Commitment

You must have a letter from each third party contributing cost sharing (i.e., a party other than the organization submitting the application) that proposes to provide all or part of the required cost sharing. **All Letters of Commitment must be attached to the Project Narrative File.** The letter must state that the third party is committed to providing a specific minimum dollar amount of cost sharing. In the budget justification, identify the following information for each third party contributing cost sharing: (1) the name of the organization; (2) the proposed dollar amount to be provided; (3) the amount as a percentage of the total project cost; and (4) the proposed cost sharing – cash, services, or property.

Letters of Commitment from parties participating in the project, exclusive of vendors, who will not be contributing cost share, but will be integral to the success of the project must also be included as part of this Appendix to the Narrative. Letters of Commitment will not count towards the Project Narrative page limit.

h. Budget for DOE Federally Funded Research and Development Center (FFRDC) Contractor File, if applicable

If a DOE FFRDC contractor is to perform a portion of the work, you must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at http://grants.pr.doe.gov. Use up to 10 letters of the FFRDC name (plus .pdf) as the file name (e.g., lanl.pdf or anl.pdf), and click on "Add Optional Other Attachment" to attach.

Summary of Required Forms/Files

Your application must include the following documents:

Name of Document	Format	File Name
SF 424 - Application for Federal Assistance	PDF	See Instructions
Other Attachments Form: Attach the following files to this form:	PDF	See Instructions
Project Summary/Abstract File	PDF	Summary.pdf
Project Narrative File, including required appendices (Letters of Commitment, Project Objectives, Project Timetable)	PDF	Project.pdf
Resume File	PDF	Resume.pdf
SF 424A Excel - Budget Information for Non-Construction Programs File	Excel	SF424A.xls
Budget Justification File (see instructions for format)	PDF	BudgetJustification.pdf
Subaward Budget Information and Justification Files, if applicable	Excel	See Instructions
Budget for DOE Federally Funded Research and Development Center (FFRDC) Contractor File, if applicable.	PDF	See instructions

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information;
- Other budget information;

- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Environmental Questionnaire;
- Representation of Limited Rights Data and Restricted Software;
- Updated submittals of any and all forms provided in the initial proposal.

E. SUBMISSION DATES AND TIMES

Application Due Date

Applications must be received by May 29, 2008, 11:59 PM Eastern Time. You are encouraged to transmit your application well before the deadline. The grants.gov Helpdesk is NOT available after 9:00 PM Eastern Time. **APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.**

F. INTERGOVERNMENTAL REVIEW

This program is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

G. FUNDING RESTRICTIONS

Cost Principles Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR Part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

H. SUBMISSION AND REGISTRATION REQUIREMENTS

1. Where to Submit

APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV, IN RESPONSE TO THIS ANNOUNCEMENT, TO BE CONSIDERED FOR AWARD.
You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements below carefully and start the process immediately.

Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

2. **Registration Process Requirements**

There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See http://www.grants.gov/applicants/get_registered.jsp. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/section3/OrganizationRegCheck.pdf to guide you through the process. IMPORTANT: During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner Identification Number" (MPIN).

Applicants, who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements, as you must COMPLETE ALL STEPS of the one-time registration process before you can submit your first application through Grants.gov.

IMPORTANT NOTICE TO POTENTIAL APPLICANTS: When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

Microsoft Vista and Office 2007 Compatibility

Grants.gov is currently incompatible with both the new Microsoft (MS) Vista Operating System and the new Microsoft (MS) Office 2007 versions of Word, Excel, and Power Point. In order to create and submit your application to Grants.gov, you must find a computer with a previous version Microsoft Operating System, such as Windows XP.

If you attach a file created using MS Office 2007, you will not get an error message when you submit the application, HOWEVER, your entire application will not be able to be processed or accepted at Grants.gov and will not reach DOE. Grants.gov can accept applications with attachments created in MS Office 2007 if the attachments are saved in the prior format. See the http://www.grants.gov/assets/Vista_and_office_07_Compatibility.pdf for detailed instructions on how to do this. A file created in MS Office 2007 can be identified by the "x" at the end of the file extension, for example "sample.docx" for a Word file. Contact Grants.gov at 1-800-518-4726 with any questions.

3. **Questions**

ALL Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII, Section A. of this announcement explains how to submit other questions to the Department of Energy (DOE), relative to the content and requirements of this announcement.

4. Application Receipt Notices

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of five e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to 2 business days from application submission to receipt of email Number 2. You will know that your application has reached DOE when the AOR receives email Number 5. You will need the Submission Receipt Number (email Number 1) to track a submission. The titles of the five e-mails are:

Number 1 - Grants.gov Submission Receipt Number
Number 2 - Grants.gov Submission Validation Receipt for Application Number
Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number
Number 5 - DOE e-Center Grant Application Received

The last email will contain instructions for the AOR to register with the DOE e-Center. If the AOR is already registered with the DOE e-Center, the title of the last email changes to:
Number 5 – DOE e-Center Grant Application Received and Matched

This email will contain the direct link to the application in IIPS. The AOR will need to enter their DOE e-Center user id and password to access the application.

5. Change in Applicant Status Prior to Selection

In the event of a significant change in the status of an applicant or their ability to perform the work presented in the application prior to the anticipated selection date, the applicant is required to notify the DOE Agency Contact for this FOA via the email address listed in Part VII, B. Examples of a significant change would be a change in Corporate Ownership, or spin-off of a specific business unit, or any other material change that impacts the accuracy of information provided in the original application. **IMPORTANT - Failure to provide this notification to DOE may disqualify an Applicant from being considered for selection for negotiation of award.**

PART V - APPLICATION REVIEW INFORMATION

A. REVIEW CRITERIA

1. Initial Review Criteria

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for an award; (2) the information required by the FOA has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the FOA; and (5) the project is at or below the specified ceiling limit. If an application fails to meet these requirements, it may be deemed non-responsive and eliminated from full Merit Review.

2. Merit Review Criteria

Applications will be evaluated against the merit review criteria shown below.

Criterion 1: Technical Merit
Weight: [35%]

- Adequacy of the discussion on the novelty, innovation, uniqueness, and originality of the technical approach to achieve desired pyrolysis oil stability.
- Validity of the proposed technical approach and likelihood of success based on the soundness of the scientific principles employed in the proposed technology.
- Extent to which the proposed work will complement or advance the current state-of-the-art for stabilizing biomass pyrolysis oil.
- Adequacy of the discussion of how the proposed technology will achieve the desired pyrolysis oil stability and why it is superior to currently applied approaches.
- Extent to which the proposed work will comprehensively address all aspects of the pyrolysis oil stability issue (viscosity – TAN – particulates).

Criterion 2: Technical Approach and Management Plan
Weight: [25%]

- Degree to which the technical approach is clearly stated, achievable, and technically feasible in responding to the FOA objectives.
- Development of a comprehensive and complete work plan and schedule with milestones and interrelated tasks that clearly lead to successful completion of the project.
- Extent to which the proposed work will gather data to demonstrate a cost effective technical approach to improved pyrolysis oil stability.
- The extent to which the proposed tasks are adequate and complete in meeting the proposed objectives, and the clarity and thoroughness in which those tasks are described, as well as the feasibility of completing the tasks in the time scheduled.
- Adequacy of the discussion on the characterization of pyrolysis oil samples in describing the specific analysis, analytical techniques used, and any important consideration related to analyzing pyrolysis oil.

Criterion 3: Applicant and Participant Strength of Team
Weight: [20%]

- Evidence of current organizational experience and knowledge in working with and understanding the properties of biomass pyrolysis oil.
- Adequacy of the discussion of experience and availability of key personnel to complete the proposed project. The discussion should include relevant experience in biomass pyrolysis oil production, handling, processing, or upgrading.
- Adequacy of the description (quality, availability, and appropriateness) of facility and equipment to accommodate the proposed project. This should include pyrolysis oil generating equipment if manipulation of the pyrolysis oil chemistry during the pyrolysis step is being proposed, the availability of proper oil storage facilities, and availability of analytical capabilities for determining pyrolysis oil properties such as TAN and viscosity.

- Degree to which key personnel are qualified and experienced.
- Level of participation by project Participants as evidenced by letter(s) of commitment.

Criterion 4: Commercialization Strategy
Weight: [20%]

- Adequacy of the discussion of the viability and practicality of the proposed technology to meet the needs of the emerging pyrolysis oil upgrading industry in a cost effective manner. This should take into consideration technical, regulatory, economic, environmental, or any other issues that may impact market success.
- Adequacy of the discussion describing experience, past successes, ability, and willingness to license and market the resulting technology to the public.
- Adequacy of the discussion of the commercialization strategy for the proposed technology and of the intellectual property rights and/or institutional alliances to execute the commercialization strategy.

3. Other Selection Factors

The Selection Official may consider the following program policy factors in the selection process:

- Awards that represent a diversity of technical approaches and methods to achieve the stated goals of the FOA;
- Amount of cost share in excess of minimum required; and
- Congruity to current DOE Portfolio: Project provides needed portfolio diversity, contributes to portfolio balance across priority technical areas, and /or provides needed adjustment in portfolio risk profile to achieve desired balance with respect to technical approaches, stages of development, and technical and commercialization risks

Office of the Biomass Program Thermochemical Platform: http://obpreview07.govtools.us/thermochem/documents/TC%20Conversion%20MYPP%20Section_6-25.doc.

B. REVIEW AND SELECTION PROCESS

a. Merit Review

Applications that pass the initial review will be subjected to a merit review in accordance with the guidance provided in the ”Department of Energy Merit Review Guide for Financial Assistance and Unsolicited Proposals.” This guide is at http://www.management.energy.gov/documents/meritrev.pdf.

b. Selection

The Selection Official may consider the merit review recommendation, program policy factors, and the amount of funds available.

c. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including, but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

DOE anticipates notifying applicants selected for award by the middle of August 2008 and making awards by the end of September 2008.

PART VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES

1. Notice of Selection

DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Part IV.G with respect to the allowability of pre-award costs.)

Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award

A Notice of Financial Assistance Award issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference: 1. Special Terms and Conditions; 2. Applicable program regulations, if any; 3. Application as approved by DOE; 4. DOE assistance regulations at 10 CFR part 600, or, for Federal Demonstration Partnership (FDP) institutions, the FDP terms and conditions; 5. National Policy Assurances To Be Incorporated As Award Terms; 6. Budget Summary; 7. Federal Assistance Reporting Checklist, which identifies the reporting requirements; 8. Intellectual Property provisions; and 9. Statement of Project Objectives.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: http://ecfr.gpoaccess.gov), except for grants made to

Federal Demonstration Partnership (FDP) institutions. The FDP terms and conditions and DOE FDP agency specific terms and conditions are located on the National Science Foundation web site at http://www.nsf.gov/awards/managing/fed_dem_part.jsp.

2. Special Terms and Conditions and National Policy Requirements

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://management.energy.gov/business_doe/business_forms.htm under Award Terms. The National Policy Assurances To Be Incorporated As Award Terms are located at http://management.energy.gov/business_doe/business_forms.htm under Award Terms.

3. Intellectual Property Provisions

The standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.doe.gov/financial_assistance_awards.htm.

4. Statement of Substantial Involvement

Either a grant or cooperative agreement may be awarded under this program announcement. If the award is a cooperative agreement, the DOE Specialist and DOE Project Officer will negotiate a Statement of Substantial Involvement prior to award.

C. REPORTING

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The proposed Checklist for this program can be found at https://www.eere-pmc.energy.gov/procurenet/FinancialAssistance/Forms/DOE_Forms/DOEF4600_2.doc.

A Project Management Plan will be required thirty (30) days after award. The template for this document will be provided to recipients of awards.

PART VII - QUESTIONS/AGENCY CONTACT

A. QUESTIONS

Questions regarding the content of the announcement must be submitted through the "Submit Question" feature of the DOE Industry Interactive Procurement System (IIPS) at http://e-center.doe.gov. Locate the program announcement on IIPS and then click on the "Submit Question" button. Enter required information. You will receive an electronic notification that your question has been answered. DOE will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website. Potential applicants are encouraged to read all posted Q&A prior to posting a new question.

Questions relating to the registration process, system requirements, how an application form works, or the submittal process are not answered via the DOE IIPS "submit question" feature, and must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE cannot answer these questions. (See Part IV, Section H.)

B. AGENCY CONTACT

Email: GO98018@go.doe.gov

All questions should be submitted through the "Submit Question" feature of IIPS. (See Part A of this Part, above.)

PART VIII - OTHER INFORMATION

A. MODIFICATIONS

Notices of any modifications to this announcement will be posted on Grants.gov and the DOE Industry Interactive Procurement System (IIPS). You can receive an email when a modification or an announcement message is posted by joining the mailing list for this announcement through the link in IIPS. When you download the application at Grants.gov, you can also register to receive notifications of changes through Grants.gov.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY APPLICATION INFORMATION

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the project narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application 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. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation."

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM

Patent Rights. The Government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data. Normally, the Government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to ensure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

I. NOTICE OF RIGHT TO CONDUCT A REVIEW OF FINANCIAL CAPABILITY

DOE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

J. NOTICE OF POTENTIAL DISCLOSURE UNDER FREEDOM OF INFORMATION ACT

Applicants should be advised that identifying information regarding all applicants, including applicant names and/or points of contact, may be subject to public disclosure under the Freedom of Information Act, whether or not such applicants are selected for negotiation of award.

REFERENCE MATERIAL

Appendix A – Definitions

"Amendment" means a revision to a Funding Opportunity Announcement

"**Applicant**" means the legal entity or individual signing the Application. This entity or individual may be one organization or a single entity representing a group of organizations (such as a Consortium) that has chosen to submit a single Application in response to a Funding Opportunity Announcement.

"**Application**" means the documentation submitted in response to a Funding Opportunity Announcement. NOTE: Application is referred to as Proposal in IIPS.

"Authorized Organization Representative (AOR)" is the person with assigned privileges who is authorized to submit grant applications through Grants.gov on behalf of an organization. The privileges are assigned by the organization's E-Business Point of Contact designated in the CCR.

"**Award**" means the written documentation executed by a DOE Contracting Officer, after an Applicant is selected, which contains the negotiated terms and conditions for providing Financial Assistance to the Applicant. A Financial Assistance Award may be either a Grant or a Cooperative Agreement.

"**Budget**" means the cost expenditure plan submitted in the Application, including both the DOE contribution and the Applicant Cost Share.

"**Consortium (plural consortia)**" means the group of organizations or individuals that have chosen to submit a single Application in response to a Funding Opportunity Announcement.

"**Contracting Officer**" means the DOE official authorized to execute Awards on behalf of DOE and who is responsible for the business management and non-program aspects of the Financial Assistance process.

"**Cooperative Agreement**" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and Substantial Involvement (see definition below) is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"**Cost Sharing**" means the respective share of Total Project Costs to be contributed by the Applicant and by DOE. The percentage of Applicant Cost Share is to be applied to the Total Project Cost (i.e., the sum of Applicant plus DOE Cost Shares) rather than to the DOE contribution alone.

"Central Contractor Registry (CCR)" is the primary database which collects, validates, stores and disseminates data in support of agency missions. Funding Opportunity Announcements

which require application submission through Grants.gov require that the organization first be registered in the CCR at http://www.grants.gov/CCRRegister.

"Credential Provider" is an organization that validates the electronic identity of an individual through electronic credentials, PINS, and passwords for Grants.gov. Funding Opportunity Announcements which require application submission through Grants.gov require that the individual applying on behalf of an organization first be registered with the Credential Provider at https://apply.grants.gov/OrcRegister.

"Data Universal Numbering System (DUNS) Number" is a unique nine-character identification number issued by Dun and Bradstreet (D&B). Organizations must have a DUNS number prior to registering in the CCR. Call 1-866-705-5711 to receive one free of charge. http://www.grants.gov/applicants/request_duns_number.jsp

"E-Business Point of Contact (POC)" is the individual who is designated as the Electronic Business Point of Contact in the CCR registration. This person is the sole authority of the organization with the capability of designating or revoking an individual's ability to submit grant applications on behalf of their organization through Grants.gov.

"E-Find" is a Grants.gov webpage where you can search for Federal Funding Opportunities in FedGrants. http://www.grants.gov/search/searchHome.do

"**Financial Assistance**" means the transfer of money or property to an Applicant or Participant to accomplish a public purpose of support authorized by Federal statute through Grants or Cooperative Agreements and sub-awards. For DOE, it does not include direct loans, loan guarantees, price guarantees, purchase agreements, Cooperative Research and Development Agreements (CRADAs), or any other type of financial incentive instrument.

"Federally Funded Research and Development Center (FFRDC)" means a research laboratory as defined by Federal Acquisition Regulation 35.017.

"Funding Opportunity Announcement (FOA)" is a publicly available document by which a Federal agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, notices of funding availability, solicitations, or other names depending on the agency and type of program.

"Grant" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and no Substantial Involvement is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"Grants.gov" is the "storefront" web portal which allows organizations to electronically find and apply for competitive grant opportunities from all Federal grant-making agencies. Grants.gov is THE single access point for over 900 grant programs offered by the 26 Federal grant-making agencies. http://www.grants.gov

"Industry Interactive Procurement System (IIPS)" is DOE's Internet-based procurement system which allows access to DOE's business opportunities database, allows user registration and submittal of Applications: http://e-center.doe.gov/.

"**Key Personnel**" means the individuals who will have significant roles in planning and implementing the proposed Project on the part of the Applicant and Participants, including FFRDCs.

"Marketing Partner Identification Number (MPIN)" is a very important password designated by your organization when registering in CCR. The E-Business Point of Contact will need the MPIN to login to Grants.gov to assign privileges to the individual(s) authorized to submit applications on behalf of your organization. The MPIN must have 9 digits containing at least one alpha character (must be in capital letters) and one number (no spaces or special characters permitted).

"**Participant**" for purposes of this Funding Opportunity Announcement only, means any entity, except the Applicant substantially involved in a Consortium, or other business arrangement (including all parties to the Application at any tier), responding to the Funding Opportunity Announcement.

"**Project**" means the set of activities described in an Application, State plan, or other document that is approved by DOE for Financial Assistance (whether such Financial Assistance represents all or only a portion of the support necessary to carry out those activities).

"Proposal" is the term used in IIPS meaning the documentation submitted in response to a Funding Opportunity Announcement. Also see Application.

"Pyrolysis oil" means the collective liquid products from the rapid thermal de-polymerization of biomass substrates (cellulose, hemi-cellulose, and lignin). These liquids also include water. These liquids are also known as (a.k.a.) flash pyrolysis oils, fast pyrolysis oils, and biomass pyrolysis oil. High pressure (hydrothermal) liquefaction liquids are not of interest under this FOA and do not qualify as "pyrolysis oil" liquids.

"Recipient" means the organization, individual, or other entity that receives a Financial Assistance Award from DOE, is financially accountable for the use of any DOE funds or property provided for the performance of the Project, and is legally responsible for carrying out the terms and condition of the award.

"**Selection**" means the determination by the DOE Selection Official that negotiations take place for certain Projects with the intent of awarding a Financial Assistance instrument.

"Selection Official" means the DOE official designated to select Applications for negotiation toward Award under a subject Funding Opportunity Announcement.

"Stability of Pyrolysis oil" for purposes of this FOA means a pyrolysis oil having the following properties: reduced chemical reactivity leading to molecular weight growth of compounds

comprising pyrolysis oil, reduced total acid number (TAN), and reduced levels of char fines present in the condensed pyrolysis oil, all evidenced by slower aging as indicated by viscosity measurements.

"**Substantial Involvement**" means involvement on the part of the Government. DOE's involvement may include shared responsibility for the performance of the Project; providing technical assistance or guidance which the Applicant is to follow; and the right to intervene in the conduct or performance of the Project. Such involvement will be negotiated with each Applicant prior to signing any agreement.

"**Total Project Cost**" means all the funds to complete the effort proposed by the Applicant, including DOE funds (including direct funding of any FFRDC) plus all other funds that will be committed by the Applicant as Cost Sharing.

Appendix B – Cost Share Information

The requirement for cost sharing included in Funding Opportunity Announcements (FOAs) issued competitively by the Department of Energy (DOE) is either statutory, programmatic, or both. Certain Federal statutes require a minimum cost share, by either type of activities funded or by Program. This is known as statutory cost share. The Program may also, at its discretion, require a greater level of cost share than the statutory minimum, or require cost share when there is no minimum requirement, as it determines appropriate. This is called programmatic cost share.

Research and Development (R&D) activities (other than R&D activities related to basic science) require Recipients (those receiving the financial assistance awards from DOE) to cost share at a minimum of 20% of total project costs. Demonstration and Deployment activities require Recipients to cost share at a minimum of 50% of total project costs. These statutory requirements are prescribed in Section 988 of the Environmental Policy Act (EPAct) of 2005. Any waiver of this requirement must be approved by the Secretary of Energy.

When responding to a DOE FOA, an applicant will have the opportunity to ask questions at the DOE Industry Interactive Procurement System (IIPS) website (https://e-center.doe.gov/). Specific questions as to the acceptability and allowability of intended cost share for a proposed project in response to a FOA may be posed at this site during the time period when the FOA is open.

The regulations that govern Federal Financial Assistance for DOE are found at 10 Code of Federal Regulations (CFR) Part 600. Specifically, Section 600.313, "Cost sharing and matching" provides guidance on acceptable contributions toward cost share requirements, as well as guidance on the valuation and documentation of contributions, for "for profit" organizations. Below is a summary of these requirements as contained in the CFR. The full CFR section may be viewed using the following link: (http://www.access.gpo.gov/nara/cfr/cfr-table-search.html).

Acceptable contributions, including cash contributions and third party contributions, must be accepted as part of the applicant's cost sharing if such contributions meet all of the following criteria:

- They are verifiable from the applicant's records.
- They are not included as contributions for any other Federally-assisted project or program.
- They are necessary and reasonable for proper and efficient accomplishment of project or program objectives.
- They are allowable under 10 CFR 600.317.
- They are not paid by the Federal Government under another award unless authorized by Federal statute to be used for cost sharing or matching.
- They are provided for in the approved budget.
- They conform to other provisions of this part, as applicable.

General examples of allowable cost share are shown below. It is up to the applicant to ensure that the cost share proposed in response to this FOA is allowable under 10 CFR 600.313.

- Cash provided directly by the recipient, or a sub-recipient;
- State or local government funds provided to support the proposed project, which were not provided to the State by the Federal Government;
- Employees' salaries included in the budget, if paid by the employer (recipient or sub-recipient), and not reimbursed by the Federal funding of the project;
- Rental value of buildings or equipment necessary to the success of the proposed project, and the value of which is included in the budget for the project;
- Monetary value of Statement of Project Objectives (SOPO) activities to be performed by a third party which are included in the project budget and will not be reimbursed by Federal funds.

Appendix C – Detailed Technical Topic Area Discussion

As discussed in Part I of the FOA, it is the intent of this FOA to solicit applications for proposed methods to produce, treat, or modify pyrolysis oil such that the method renders the pyrolysis oil stable for time periods of at least six months. Stability for purposes of this FOA means the following issues are addressed:

1. Molecular building reactions of various compounds present in the pyrolysis oil are reduced as measured by the rate of increase in viscosity of the pyrolysis oil compared to the starting pyrolysis oil. It is desired to reduce the rate of increase in viscosity by ten orders of magnitude compared to the original standard pyrolysis oil. See Appendix D for the requirements for storage and measurement of processed pyrolysis oil.
2. Reduction of the total acid number (TAN) to less than 5 by reducing the carboxylic functionality in compounds present in the pyrolysis oil.
3. Removal of residual char fines from the pyrolysis oil as measured by pyrolysis oil ash content to less than 0.01 wt%.

Proposed methods can include manipulations of the pyrolysis oil chemistry during the initial pyrolysis step or as a post pyrolysis step in vapor or liquid phase. Post pyrolysis reaction with alcohols, although known to be effective, is not a desired approach because it is viewed as expensive and cumbersome in distributed production applications. Applications involving this technique will be considered non-responsive to this FOA and rejected for consideration. Depending on the proposed approach to stabilize pyrolysis oil, successful applicants will be provided standardized samples of either woody biomass or pyrolysis oil made from this same woody biomass. To ensure valid comparisons can be made between various proposed approaches these will be the only materials used in projects selected under this FOA. Individual projects requesting samples of pre-prepared pyrolysis oil are advised to store the pyrolysis oil in a refrigerated environment to avoid elevated temperature induced stability changes.

It is well known that cyclones are relatively ineffective separation devices for particles less than 3 microns in size. In addition the aggressive velocities and particle collision dynamics in the tangential entrance of cyclones is likely to produce even more fines that carry over to the condensed pyrolysis oil. Because of these issues the use of cyclones is not deemed an acceptable stand-alone approach for removal of char fines from pyrolysis oil. Applications proposing only this char removal technique will be considered nonresponsive to this FOA.

To gain insight into the root chemical causes for instability, applicants must provide a discussion on the physico-chemical characterization they intend to conduct on pyrolysis oil they will either produce or modify. At a minimum the discussion must include compound class characterization, total acid number, water content, and particulate/ash content. The discussion should also describe how physico-chemical attributes will be correlated with pyrolysis oil stability related to the given technical approach to improve stability.

The technical approaches to addressing the pyrolysis oil stability problem are intended to be applicable in both stand alone as well as distributed processing facilities. Therefore it is desirable to have technical approaches that are relatively simple and cost effective for both types of applications. To assess the relative cost for a given technical approach, applicants are

required to provide preliminary cost estimates measured in dollars per gallon of produced pyrolysis oil. Include assumptions made in determining cost estimates.

Appendix D – Pyrolysis Oil Storage and Stability Measurements

Because pyrolysis oil stability is strongly influenced by temperature, it is necessary to establish consistent protocols for the storage, handling, and measurement of pyrolysis oil. For general storage during times when experimental activity is not occurring, pyrolysis oil must be kept in a refrigerated environment to minimize chemical reactions. Following experimental activities to improve pyrolysis oil stability, accelerated aging studies will be conducted to assess the efficacy of the applied approach. During the accelerated aging studies periodic measurement of pyrolysis oil viscosity will be made. Each successful applicant will be required to carry out the accelerated aging study and viscosity measurements in the same way as described below:

Accelerated Aging Study:

Because elevated temperatures are known to increase the rate in which chemical reactions occur between various compounds comprising pyrolysis oil, storage of pyrolysis oil samples at elevated temperature for fixed time periods will be used to assess the efficacy of any given technical approach to improve stability. This will be done to shorten the length of time needed to show improvement in stability from months to days. The required temperature for accelerated aging studies is 90°C. A minimum of three viscosity measurements will be made of each pyrolysis oil sample that has been modified (or produced) in ways that improve stability. These measurements will be made at time = 0.0 hours at 90°C, time = 8.0 hours @ 90°C, and time = 24.0 hours @ 90°C. Data from this analysis shall be recorded in a table, as shown below, and reported as a Rate of Viscosity Increase, e.g. cSt/day .

Time (hours)	Viscosity (cSt)	Measurement taken at Temperature (°C)
t_0		40
8 hours storage at 90°C		
t_0 + 8 hours		40
16 hours storage at 90°C		
t_0 + 24 hours		40
Viscosity Increase (cSt/day)		

Pyrolysis oil samples must be stored in sealed containers to prevent loss of volatile compounds that would erroneously effect the viscosity measurement. When conducting viscosity measurements on elevated temperature stored samples, allow samples to cool to the viscosity measurement temperature (see below) before removing sealed container lid. Use caution when doing this as it is possible for pressure to build in the head space during elevated temperature storage.

Viscosity Measurement

Experience has shown that the measured viscosity can be influenced by the temperature at which

the measurement is made. Consequently all viscosity measurements shall be measured at a pyrolysis oil temperature of 40°C. Various types of viscometers are available and successful applicants may use the one of their choosing that is also compatible with ASTM D 445. The only requirement is that the same instrument be used for all viscosity measurements.