



Feedstock-Conversion Interface Consortium (FCIC) Directed Funding Opportunity (DFO)

Section I – Description

To accelerate innovation and adoption of new technologies to determine the root cause of biomass handling failures and designing solutions, the Feedstock-Conversion Interface Consortium (FCIC) is overseeing a national laboratory Directed Funding Opportunity (DFO) call. Interested industrial and academic partners wanting to collaborate with research experts and leverage unique technology capabilities at the U.S. Department of Energy (DOE)'s national laboratories are encouraged to apply.

Lignocellulosic biorefineries' development and operation have suffered from failing to account for the complexity and variability of feedstock properties and composition, lack of fundamental understanding of the physics and chemistry of biomass derived feedstock preprocessing and subsequent deconstruction, poor equipment design, and flawed integration. Understanding the potential range of desired biomass specifications will enable effective handling strategies and will lead to predictable conversion performance and improvement of process economics in lignocellulosic industrial biorefineries.

A successful bioeconomy is imperative for reducing dependence on foreign sources of energy, increasing global market competitiveness, enabling agricultural development, securing environmental sustainability, and producing domestic jobs toward an affordable and resilient bioeconomy.

In response to this need, the DOE Bioenergy Technologies Office (BETO), part of the Office of Energy Efficiency and Renewable Energy (EERE), established the FCIC, a consortium of DOE national laboratories with expertise in driving research and development in biomass feedstocks supply, preprocessing, and conversion technologies. As part of the FCIC program, the participating national laboratories apply technical competence and unique capabilities for early to mid-stage research dedicated toward commercializable solutions to challenges that impede integrating unit operations in 2nd generation biorefineries to produce biofuels and bioproducts from lignocellulosic biomass.

The purpose of this DFO is to facilitate focused R&D to understand the root causes of feed handling failures and develop integratable technologies to increase the on-stream operational reliability of biorefineries by providing industry partners with access to the FCIC resources network. Interested industry or academia are encouraged to submit research proposals, in collaboration with national labs, to address the most pressing industrial feedstock handling, preprocessing, and conversion challenges related to feedstock chemical, physical, and mechanical variability.

Teams should identify technical challenges that could benefit from this DOE national laboratory DFO to accelerate their R&D and technology advancement. Selected projects will (1) be partnerships between

industry and one or more FCIC member national laboratories with the most compelling relevant capabilities and expertise and (2) enter into an FCIC DFO agreement pre-negotiated by FCIC member national laboratories.

Section II – Opportunity and Award Information

Selected projects will receive between \$500,000 and \$2,000,000 for 12–22 months. FCIC anticipates issuing up to 6 awards under this funding opportunity. Industrial and academic partners will fund their own labor, materials, and other expenses directly, which will contribute toward a 30% minimum in-kind or cash cost-share requirement (i.e., \$30,000 industrial cost share required for a \$70,000 federal funding request). They will receive no federal funds; federal funds will be awarded for selected projects to cover FCIC network laboratory contributions.

Contractual terms will be managed through a pre-established FCIC agreement.

FCIC is specifically interested in receiving applications in the following topic areas: biomass quality evaluation and optimization, biomass preprocessing and feed-handling process integration, and system readiness evaluation through techno-economic analysis and process control development.

For each of these areas, FCIC has listed topics of interest and will consider other topics that industry/academia/FCIC teams jointly propose to accelerate progress toward achieving the purpose of this DFO.

Topic Area 1: Biomass Quality Evaluation and Optimization

0–3 awards of \$500,000–\$2,000,000 for each anticipated project.

Suggested topics:

- 1) Develop novel analytical biomass characterization methods to inform downstream integrated processes allowing real-time adjustments to processes environment (i.e., speed, preprocessing, severity, catalyst lifetime, yield).
- 2) Identify the range of variability for physical, mechanical, and/or chemical characteristics for loblolly pine residues and/or corn stover to associate major contributing factors influencing biorefinery feed-handling, storage, preprocessing, and conversion performance.
- 3) Develop novel computational biomass (dry and/or wet) flow and behavior models to understand behaviors of complex biomass in hoppers, bins, or auger systems to predict and improve the design and testing of biomass handling unit operations.

Topic Area 2: Biomass Preprocessing, Feed-Handling, and Conversion Process Integration

0–3 awards of \$500,000–\$2,000,000 for each anticipated project.

Suggested topics:

- 1) Design improvements to the feed-handling and preprocessing integrated biorefinery equipment that could benefit either thermochemical conversion of loblolly pine (2013 Pyrolysis and upgrading to hydrocarbon design case, <https://www.nrel.gov/docs/fy14osti/61178.pdf>) or biochemical conversion of corn stover (2011 Biochemical corn stover to ethanol design case, <https://www.nrel.gov/docs/fy11osti/47764.pdf>), with a focus on the steps after field-harvest through to the conversion reactor throat. Projects on other feedstock types and conversion pathways should show relevance to the suggested topics.
- 2) Develop mitigation strategies to improve process robustness and operation reliability of integrated unit operations while maintaining or improving conversion performance and process economics.

Topic Area 3: System Readiness Evaluation through Techno-economic Analysis and Process Control Development

0–3 awards of 500,000–\$2,000,000 for each anticipated project.

Suggested topics:

- 1) Establish analytical framework to enable robust modular techno-economic or life-cycle analysis models to analyze the effect differences in biomass variability have on the supply, storage, preprocessing, and biorefinery performance, cost and yield of either thermochemical conversion of loblolly pine or biochemical conversion of corn stover.
- 2) Identify and prioritize pinch points across entire field-to-conversion process to prioritize remaining improvements moving forward to model nth plant targets.
- 3) Develop and implement intelligent, adaptive control strategies and/or in-line instrumentation to feedstock handling, preprocessing, and low-temperature and high-temperature deconstruction operations based on key feedstock or intermediate attributes to improve operational reliability while maintaining conversion performance and cost target.

FCIC reserves the right to make more, fewer, or even no awards in each topic area depending on funding availability and/or the quality of the applications.

Project Success Metrics

- By accessing FCIC resources, the industry team is able to dramatically accelerate (2x or greater) the development cycle to deployment, or dramatically improve the preprocessing and handling of biomass or the design of equipment and manufacturing process, when compared to a comparable project without access to FCIC capabilities.
- Following project completion, the material or manufacturing process stands a significant chance of being moved into commercial production within 5 years. (Note: the 5-year horizon ensures FCIC is not applied as a core technology development mechanism, but rather a way to address targeted challenges in industry in a fairly quick and agile fashion.)
- The responsibility for tracking results will fall to FCIC, which will leverage the processes employed by the DOE programs for tracking milestones and progress.

Project Information Summary

- Total duration will be 12–22 months.
- Industrial/Academic cost share (in-kind) will be at least 30% of the total project cost.
- Total DOE share per project will be less than or equal to \$2,000,000.
- Qualifying scope must be related to achieving improvement to biomass feed-handling while maintaining or improving conversion performance and cost target, and within the topic focus areas for the specified DFO call.
- Applications working to improve the biomass handling and conversion performance of corn stover or loblolly pine residues with the low temperature or high temperature pathway specified in Topic Area 2 will be encouraged. Other feedstocks types and conversion pathways will be eligible with the justification of relevance to the FCIC objectives and goals.
- All projects must show potential benefit with techno-economic analysis to metricize the improvement to a process.
- Funding allocations of selected projects are dependent on available FCIC budget with the entirety of DOE funding for the duration of the project available at the time of project kickoff.

Section III – Eligible Applicants

Individuals

U.S. citizens and lawful permanent residents are eligible to apply as prime (lead organization) or subawardee (team member).

Domestic Entities

For-profit entities, educational institutions, and nonprofit entities that are incorporated (or otherwise formed) under the laws of a particular State or territory of the United States are eligible to apply as the prime (lead organization) or subawardee (team member).

State, local, and tribal government entities are eligible to apply as the prime (lead organization) or subawardee (team member).

FCIC network DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) and Non-DOE/NNSA FFRDCs are eligible to apply.

Foreign Entities

A foreign entity with a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States may participate as a subawardee under this DFO.

Performance of Work in the United States

All work performed under the DFO Awards must be performed in the United States (i.e., awarded project must expend 100% of its total project costs in the United States).

This requirement does not apply to travel, to equipment, to materials and supply purchases. Furthermore, to the greatest extent practicable, all equipment and products purchased with funds made available under awards resulting from this DFO should be American-made.

Section IV – Application Submission Information

Industrial and academic partners are asked to submit a full research application identifying a technical challenge and the related capability needs available from the FCIC. Applicable forms and instructions are available at the [FCIC website](#). Applicants will need to create an account at fcic.inl.gov in order to submit an application. To submit, (1) go to fcic.inl.gov, (2) select “Applicant Login” from the left menu bar, (3) enter user credentials or click on the “Create New Account Link” to set up a new account, (4) select “Applications” from the top menu, and (5) click on “Create New Application” for the FY 2018 FCIC DFO to launch an application form.

Applications should be prepared using standard 8.5” x 11” paper with 1-inch margins (top, bottom, left, right), Times New Roman font, and no smaller than 11 point. The preferred file format is Adobe Portable Document Format (PDF) or Microsoft Word (.doc or .docx). (Note: Do **not** place a protection on uploaded documents.) Applications must be no more than 20 pages in length and uploaded using the online submittal system at fcic.inl.gov. Proprietary and sensitive information should not be included in the application.

For more information about FCIC, please refer to fcic.inl.gov. Questions relating to the online submittal system must be directed to fcic@inl.gov.

Directed Funding Opportunity Timeline

Timeline of Directed Funding Opportunity (DFO)	
Date	Action
December 6, 2017	Notice of Intent
December 20, 2017	Call Released
January 31, 2018 (by 10:00 PM ET)	Submission Deadline
March 15, 2018	Anticipated Selection Announcement
TBD	Awards Issued

File Attachments

Summary Slide

The Summary Slide should highlight project’s (1) objectives, (2) technical approach, (3) milestones and outcomes, and (4) impact to FCIC goals and mission.

A template for the Summary Slide is available at fcic.inl.gov (“News and Opportunities”).

Statement of Project Objectives (20-page maximum)

The Statement of Project Objectives should be structured with the following sections:

1. Introduction (~2 pages)

Provide a brief overview of the technical problem, target application, and proposed approach to achieving a solution. Provide any background information necessary for understanding the scope of the problem or the impact of a solution.

2. Challenges Addressed, Risk Mitigations, and Research Approach (~5–10 pages)

Provide a brief discussion of the challenges addressed, research approach and the innovative aspects of the approach, and how this addresses the challenges identified. Describe the risks associated with the proposed approaches outlined above and the risk mitigation techniques and strategies available to address them.

3. Impact and Benefit to FCIC, 2nd Generation Biofuel Biorefineries, and the Bioeconomy (~2–5 pages)

Provide an analysis and discuss the potential impact of the project’s success on the 2nd generation biorefineries on-stream reliability, conversion performance and cost target. Discuss the specific application or unit operation(s) of the technology/process in a defined system, including techno-economic analysis and impact to a biorefinery output.

4. Requested Budget, Milestones, and Key Personnel (~2–5 pages)

Milestones – Provide the project milestones and complete dates in the table below.

Milestone Name/Description	Completion Date
End of Project Milestone – SMART (Specific, Measurable, Achievable, Results-focused, Time-bound)	

Spend Plan (12 months = 4 quarters, 18 months = 16 quarters) – Populate the table with \$K per quarter for the project.

Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 5	Quarter 6

Cost Share

Participant	Federal Share (DOE)	Cost Share	Total Project Value	Proposed Cost Share Percentage
Participant 1 Name	\$K	\$K	\$K	%
Participant 2 Name	\$K	\$K	\$K	%

Project Team Vitae

Each project team member shall provide a brief vitae (1-2 pages) that lists the following:

- Contact Information
- Education and Training
- Research and Professional Experience
- Publications: Provide a list of up to 10 publications most closely related to the proposed project.
- Synergistic Activities: List no more than 5 professional and scholarly activities related to the

effort proposed.

File Attachment Summary Table

Attachment	Format	Page Limit	File Name
Technical Summary	PPT*	1 slide	FCIC_TechSummary_ID#
Statement of Project Objectives	PDF or Word	20 pages	FCIC_Statement_ID#
Project Team Vitas	PDF or Word	2 pages each	FCIC_LastName_ID#

*Template provided at fcic.inl.gov

Section V – Review Information

FCIC’s DFO review team will review each application and provide scores using the following weighted criteria. FCIC leadership team may also provide written commentary. Each review sheet and reviewer comments will be provided to FCIC leadership for consideration in concurrence of selecting projects.

Applications will be evaluated by the following categories:

1. Challenges Addressed, Risk Mitigations, and Research Approach (40% of total score)
2. Impact and Benefit to FCIC, 2nd Generation Biofuel Biorefineries, and the Bioeconomy (40% of total score)
3. Requested Budget, Milestones, and Key Personnel (20% of total score)

FCIC DFO applications will be reviewed and ranked against established criteria that align with FCIC consortium objectives. For each criterion, a score will be assigned between 1 and 5 (5 being best), reflecting whether the application makes a clear and compelling case.

Scoring Criteria

1 - Does not meet basic requirements/off topic/out of scope: The project does not advance or recognize the technical state of knowledge and understanding of the mission or relevant technical area, and is not creative or original. The scope cannot be executed fully in the facilities available.

2 - Below average: The project recognizes the technical state of knowledge and understanding of the mission or relevant technical area, and is only marginally creative and contains few original concepts. The scope will require resources not named in the project or will require additional facilities or resources to execute.

3 - Meets requirements: The project incrementally advances the technical state of knowledge and understanding of the mission or relevant technical area, and is based predominately on established concepts, with some creative, original concepts. The scope may be difficult to execute fully in the facilities available.

4 - Exceeds requirements: The project advances the technical state of knowledge and understanding of the mission or relevant technical area, and is based on some established concepts, although several creative and original concepts are presented. The scope may be executed fully in the facilities available.

5 - Exceptional approach: The project unquestionably advances the technical state of knowledge and understanding of the mission or relevant technical area, and is creative and based largely on original concepts. The scope can be executed fully in the facilities available.

Application Process Summary

- Industry partner(s) approaches FCIC concierge (fcic@inl.gov) or an FCIC partner national laboratory POC (<https://FCIC.inl.gov>) for initial discussion of project concept and resources.
- Industrial and academic partner(s) identify desired FCIC resource(s) and works with FCIC partner national laboratory to develop the application following the provided template.
- Through the FCIC website (fcic.inl.gov), the consortium receives the application submitted by teams describing project objectives, project tasks, responses to review criteria, and anticipated budget with breakdown of DOE and industry spending by major task.
- The application is sent to the FCIC review committee.

- FCIC review committee will review the applications to provide a numerical score (1–5) for each review criteria and provide comments.
- FCIC review committee members whose company or laboratory resources are included in the application abstain from reviewing but can comment on merits of the proposed use of resources.
- FCIC leadership team meets to rank applications and arrive at consensus for award recommendations.
- FCIC sends compiled scores and comments to DOE program with project selection(s).
- DOE BETO Office Leadership Team is briefed with project selections. Funding and project start are authorized by FCIC, pending negotiations.
- Awardees will be required to enter into the non-negotiable NDA with the FCIC laboratory members.
- FCIC distributes allocated funds to authorized national laboratory resources.
- FCIC-funded projects are subject to DOE review once per quarter. FCIC-funded projects are also subject to presentation at the DOE BETO Merit Review.
- FCIC partners are required to provide all project data and code (such as technical data used to support published journal articles or research code used for simulations) to the FCIC Data HUB (Bioenergy Feedstock Library, <https://bioenergylibrary.inl.gov/>) for curation and hosting (proprietary and business-sensitive data are exempt).