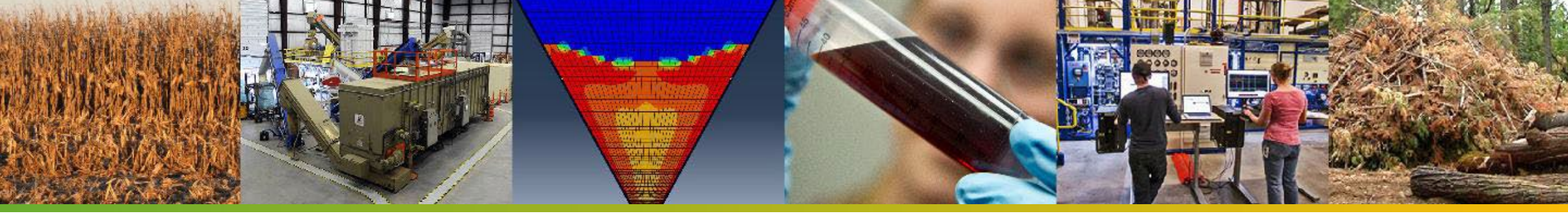


FY25 Feedstock-Conversion Interface Consortium CRADA Call

Informational Webinar

Ben Simon, Technology Manager, EERE-BETO

Ed Wolfrum, FCIC Principal Investigator

September 16, 2024

fcic
FEEDSTOCK-CONVERSION INTERFACE CONSORTIUM
U.S. DEPARTMENT OF ENERGY

Webinar Housekeeping

- Attendees will be in listen-only mode
- Audio connection options:
  - Computer audio
  - Dial in through your phone (best connection)
- Automated closed captions are available
- Use the Q&A panel to ask questions
- Technical difficulties? Contact Erik Ringle through the chat section, lower right of your screen
- Recording will be available at https://www.energy.gov/eere/bioenergy/fcic-fy25-industry-partnership-call

Today's Speakers

Ben Simon

Technology Manager, BETO

Ed Wolfrum

Principal Investigator, FCIC

Today's Speakers

Ben Simon

Technology Manager, BETO

U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

I. Biomass: Nature's Carbon Removal

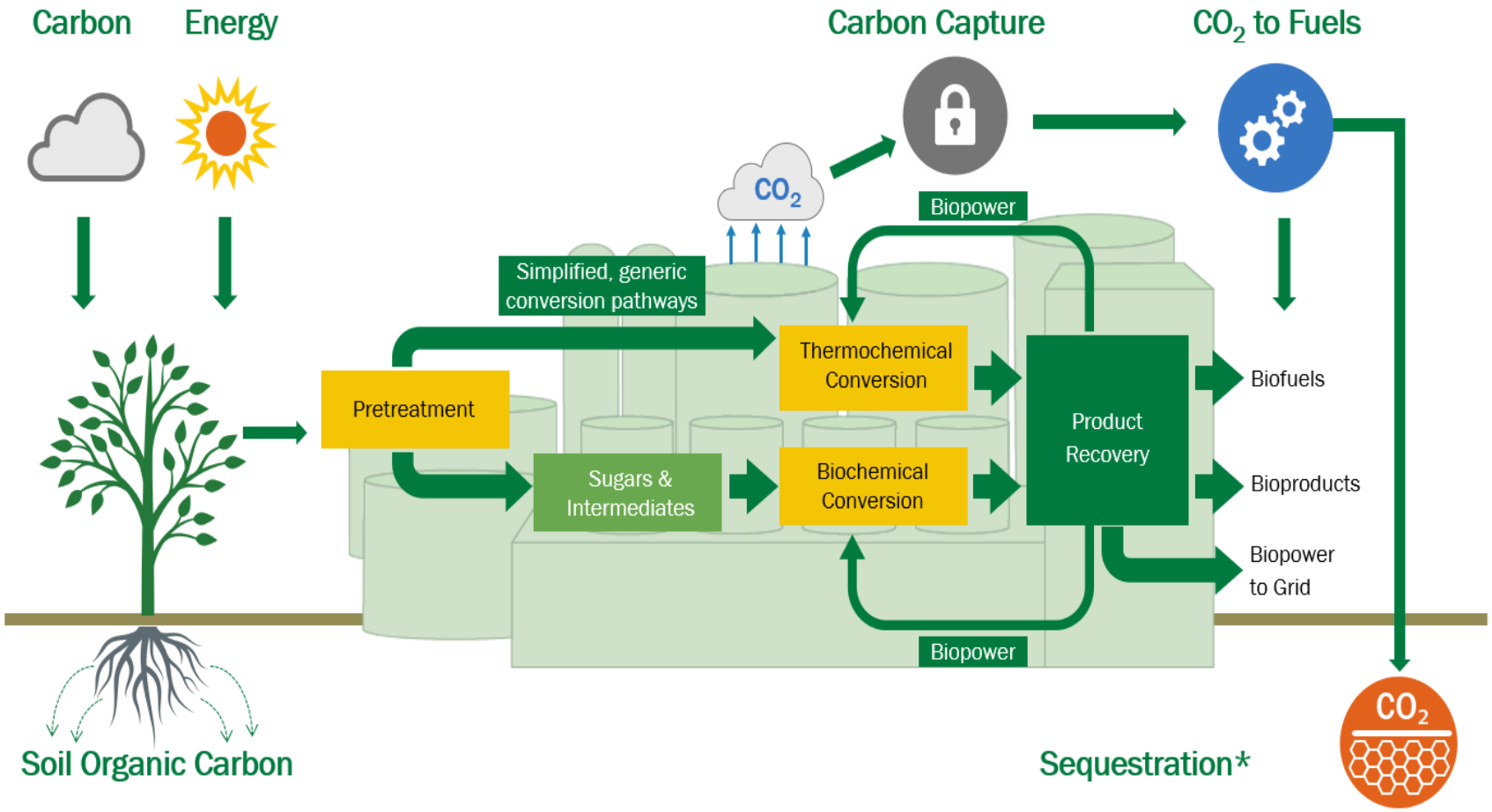
II. BETO's Goals

III. Target Bioproducts

IV. Reason for the IPC

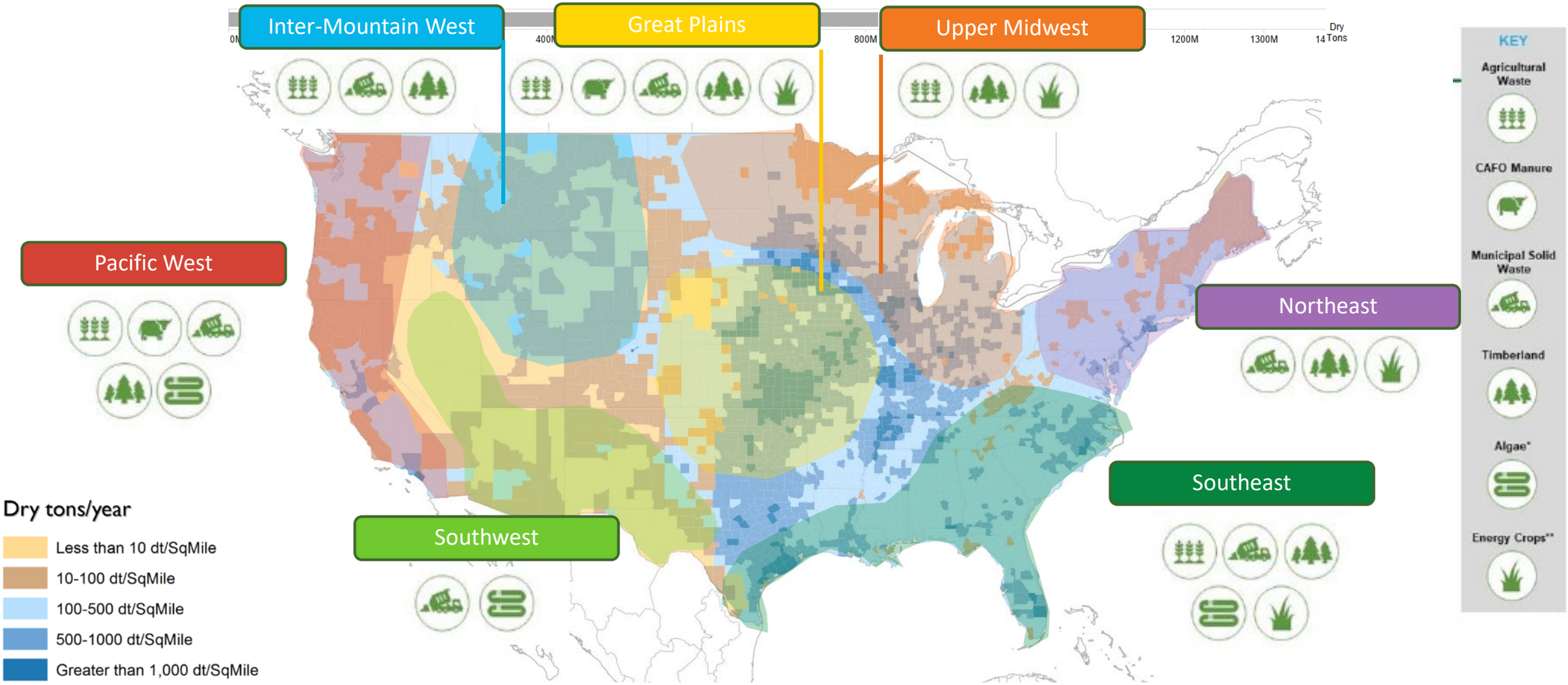
Biomass: Nature's Carbon Removal Technology

- **Biomass** includes food waste, municipal solid waste, agricultural and forest wastes, animal wastes, and energy crops.



** Office of Fossil Energy R&D on technologies of relevance to bioenergy industry.*

U.S. Regional Diversity of Biomass Resources



*Base-case scenario, $60 offered price, combined resources, year 2040

Regions adapted from Valerie Reed SMMC Presentation 2022

BETO Strategic Goals

BETO's 2023 Multi-Year Program Plan

1. Decarbonize the **transportation sector** through RD&D to produce cost-effective, sustainable aviation and other strategic fuels

2. Decarbonize the **industrial sector** through RD&D to produce cost-effective and sustainable chemicals, materials, and processes utilizing biomass and waste resources

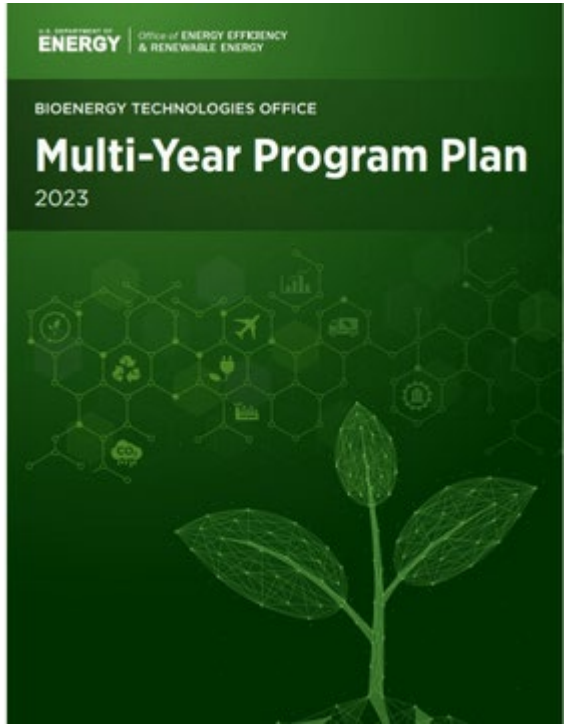
3. Develop cost-effective, sustainable biomass and waste utilization technologies and innovative approaches contributing to the decarbonization of the **agriculture sector**...or other beneficial uses

BETO Key Performance Goals

1. Enable delivery, preprocessing, and deconstruction of sufficient volumes of biomass and waste feedstocks to biofuel intermediates that can meet industry-relevant cost and performance requirements, with a focus on SAFs capable of **>70% reduction in GHG** emissions relative to petroleum

2. Along with industrial and federal partners, support 3 billions gallons of SAF production and use by 2030, consistent with a trajectory to ultimately producing 35 billion gallons by 2050 **(SAF Grand Challenge)**

3. Demonstrate **more than three place-based strategies** for climate-smart agriculture, waste management, environmental remediation, or other beneficial uses of renewable carbon resources



Products for Hard to Abate Sectors

- **Drop-In Transportation Fuels**
  - **Aviation**, **maritime**, **rail**, and **off-road** fuels have:
    - Significant GHG emissions impacts
    - Infrastructure needs for electrification and hydrogen alternatives
  - Projected growth
  - Focus: Renewable carbon sources for 100% of aviation, 50% of maritime, rail, and off-road

- **Replacement Chemicals**
  - **Chemicals** sector is the largest contributor to U.S. industrial GHG emissions
  - Projected growth
  - Focus: Polymer resins and other chemicals that need reduced-emissions feedstocks

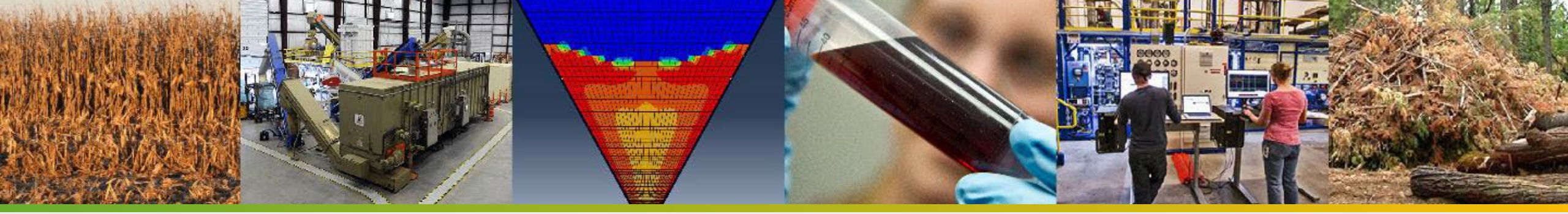
Why an Industrial Partnership Call?

- FCIC has 7+ years of experience developing tools, knowledge, and design cases for biomass variability from harvest through conversion
- Market pull to address industrial challenges in the bioenergy supply chain
- Deployment - rapid response technical assistance to quickly support project developers
- DOE National Labs contain world class expertise, facilities, capabilities, and resources – cost prohibitive for some

Today's Speakers

Ed Wolfrum

Principal Investigator, FCIC



FCIC Overview

fcic
FEEDSTOCK-CONVERSION INTERFACE CONSORTIUM
U.S. DEPARTMENT OF ENERGY

1-slide guide to the FCIC

The Feedstock-Conversion Interface Consortium is led by DOE as a collaborative effort among researchers from 9 National Labs

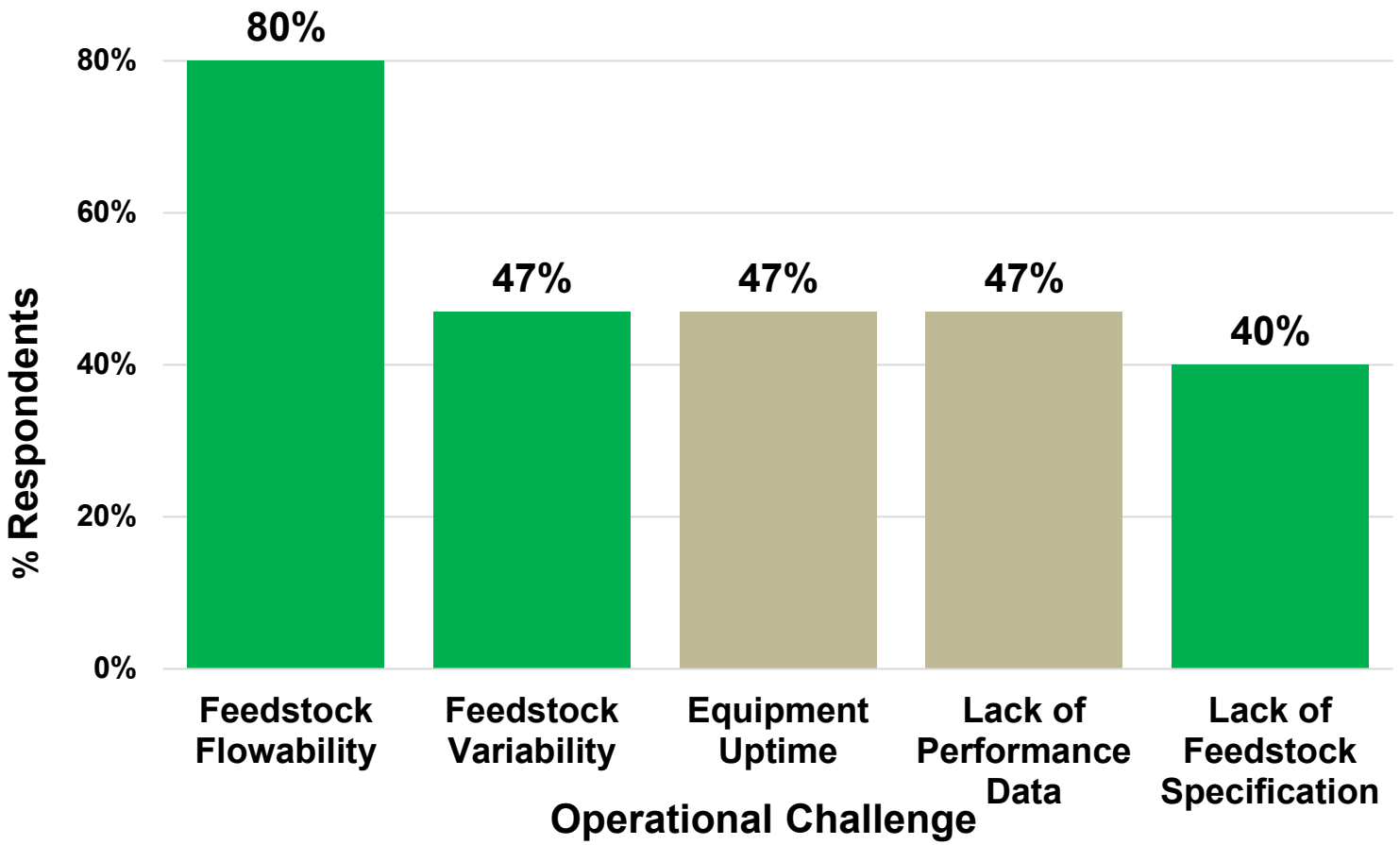
Key Ideas

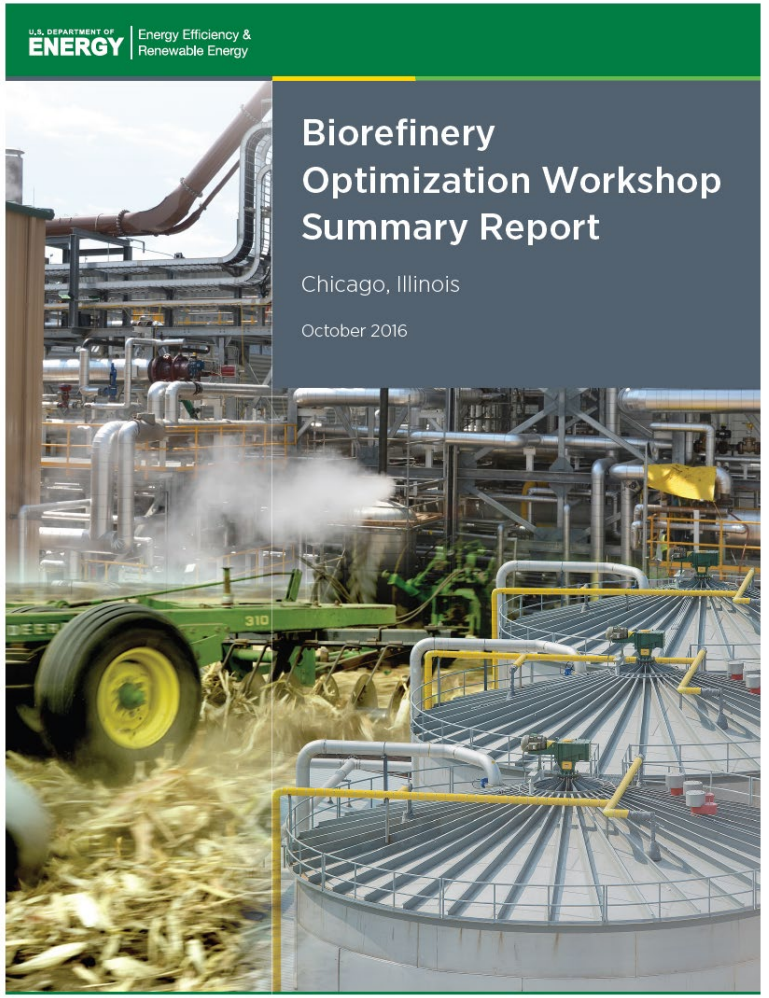
- Biomass feedstock properties are **variable** and **different** from other commodities
- **Empirical** approaches to address these issues have been **unsuccessful**

We are developing **first-principles** based knowledge and tools to **understand** and **mitigate** the effects of biomass feedstock and process **variability** on biorefineries

2016 Biorefinery Optimization Workshop

- Challenges, recommendations, and lessons learned from over 100 participants (industry, NL, academic)

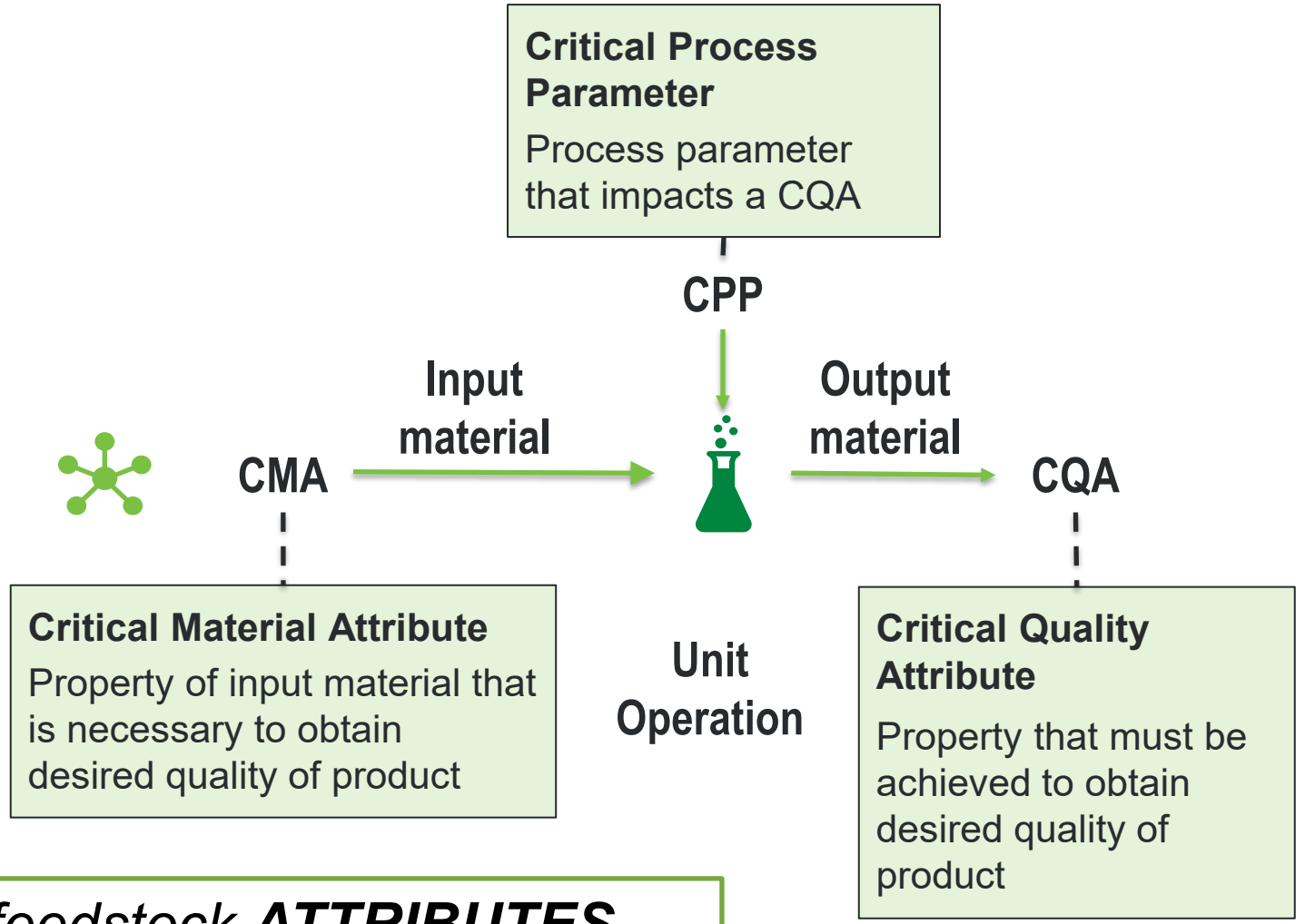




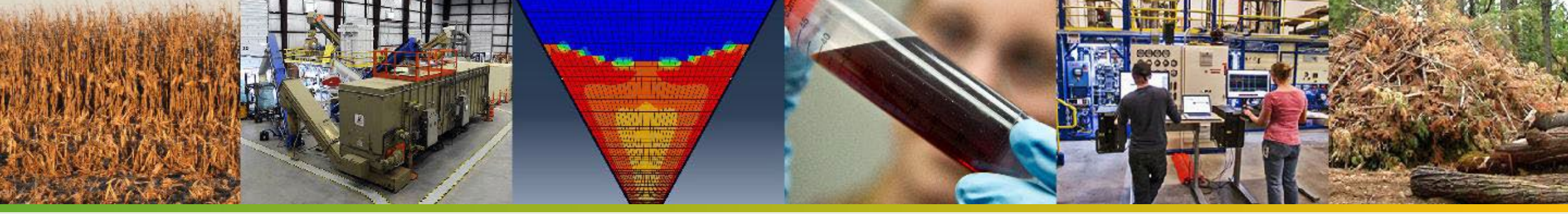
https://energy.gov/eere/bioenergy/downloads/biorefinery-optimization-workshop-summary-report

Quality by Design (QbD)

- Key operating concept and organizing principle
- Widely used in pharmaceutical manufacturing – FDA-endorsed
- Chemical processes are collections of specific unit operations
- Unit operations are discrete but connected



*Moving from feedstock **NAMES** to feedstock **ATTRIBUTES***



FY25 FCIC Industry Partnership Call

FEEDSTOCK-CONVERSION INTERFACE CONSORTIUM

U.S. DEPARTMENT OF ENERGY

Intent

- The full Industry Partnership Call (IPC) is available at https://www.energy.gov/eere/bioenergy/fcic-fy25-industry-partnership-call
- The intent of the IPC is to **apply FCIC capabilities to real world problems** that the bioenergy and bioproduct industries are facing.
- To maximize the likelihood of near-term impact for industrial partners, the FCIC wants to **leverage existing capabilities and facilities** within the consortium as opposed to projects that require the development of new capabilities.
- A full list of capabilities and tools can be found on the IPC call website

Example Capabilities

Characterizing Feedstock Variability

https://pubs.acs.org/doi/abs/10.1021/acssuschemeng.9b06263

RETURN TO ISSUE | **PERSPECTIVE** | NEXT ›

Characterizing Variability in Lignocellulosic Biomass: A Review

Jipeng Yan, Oluwafemi Oyedeji, Juan H. Leal, Bryon S. Donohoe, Troy A. Semelsberger, Chenlin Li, Amber N. Hoover, Erin Webb, Elizabeth A. Bose, Yining Zeng, C. Luke Williams, Kastli D. Schaller, Ning Sun, Allison E. Ray*, and Deepti Tanjore*

Cite this: *ACS Sustainable Chem. Eng.* 2020, 8, 22, 8059−8085
Publication Date: May 4, 2020
https://doi.org/10.1021/acssuschemeng.9b06263

Article Views 2070 | Altmetric - | Citations 33
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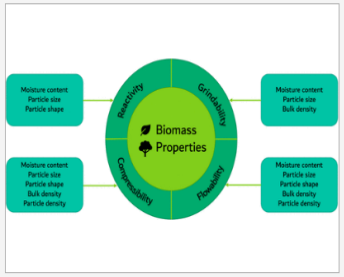
PDF (13 MB) NREL JOURNALS

SUBJECTS: Biomass, Biomaterials, Cellulose, Granular materials, Materials

ACS Sustainable Chemistry & Engineering

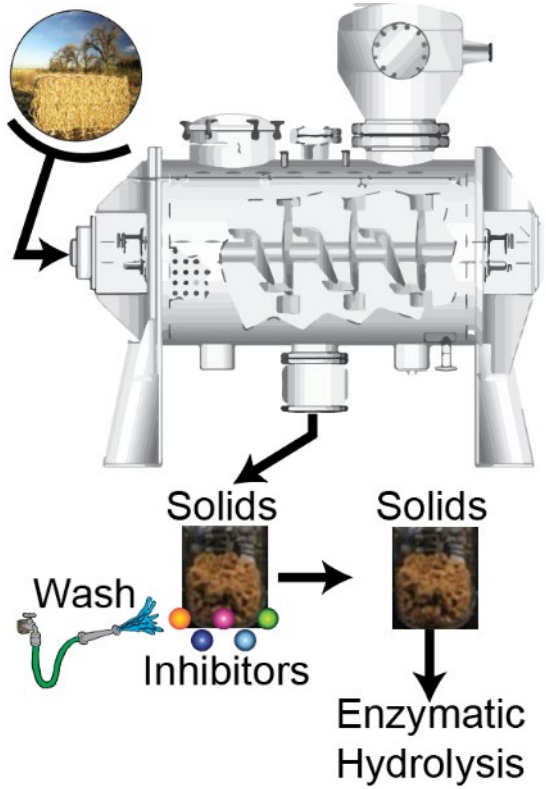
Abstract

Feedstock variability is a significant barrier to the scale-up and commercialization of lignocellulosic biofuel technologies. Variability in feedstock characteristics and behavior creates numerous challenges to the biorefining industry by affecting continuous operation and biofuels yields. Currently, feedstock variability is understood and explained largely on the basis of chemical composition. Physical and mechanical properties and behavior of lignocellulosic feedstock in various unit operations, studied through advanced analytical methods, can further explain variability. Such studies will enable us in developing processes and designing equipment to improve operation and conversion performance. In this perspective, we review several advanced analytical methods that measure density, moisture content, thermal properties, flowability, grindability, rheology properties, and micromorphological characteristics. We also discuss the correlations and interactions among these properties that reflect the complexity of lignocellulosic biomass as a feedstock and the associated quality metrics and logistics of supplying consistent quality feedstock to a biorefinery. We also examine methods that have not traditionally been used to characterize lignocellulosic feedstocks but have the potential to bridge the gap in our explanation of feedstock variability.



Examining Feedstock Impacts on Low-Temperature Conversion

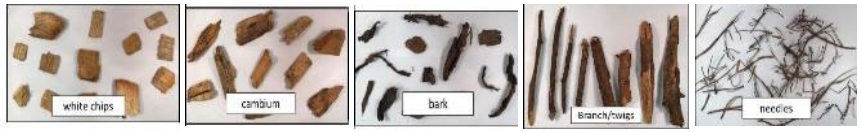
https://doi.org/10.3389/fenrg.2021.792216

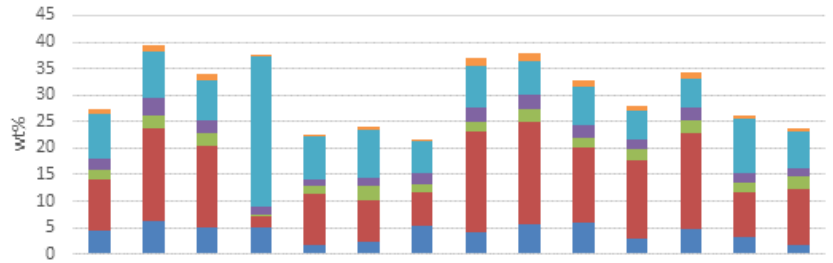


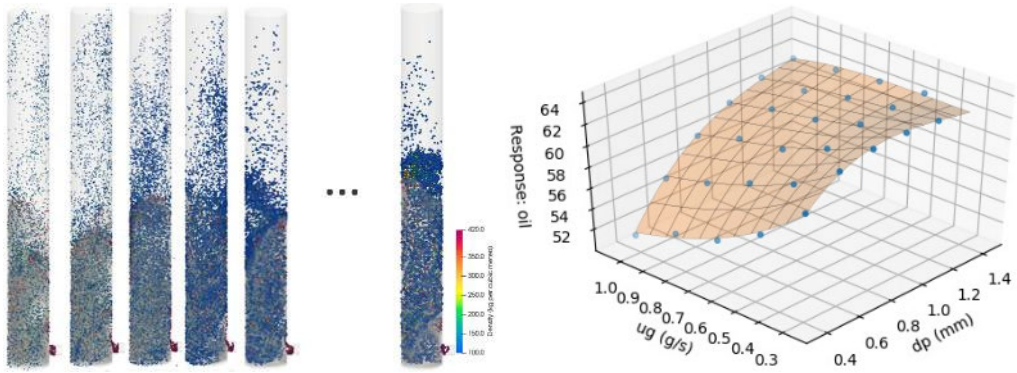
Example Capabilities (2)

Experimental and Computational Capabilities in Pyrolysis and Gasification

https://doi.org/10.1016/j.cej.2022.136920







Tools to Predict Blade Wear in Mills

https://www.anl.gov/amd/abrade-model

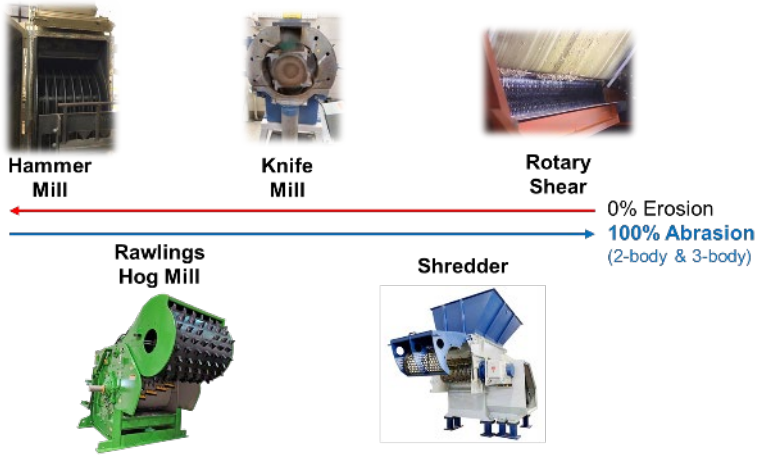
Argonne NATIONAL LABORATORY

RESEARCH

APPLIED MATERIALS

ABRADE Model

ABRADE is an Excel-based model that calculates the recession of the leading edge of a knife blade due to abrasion by hard inorganic particles entrained in biomass feedstock.

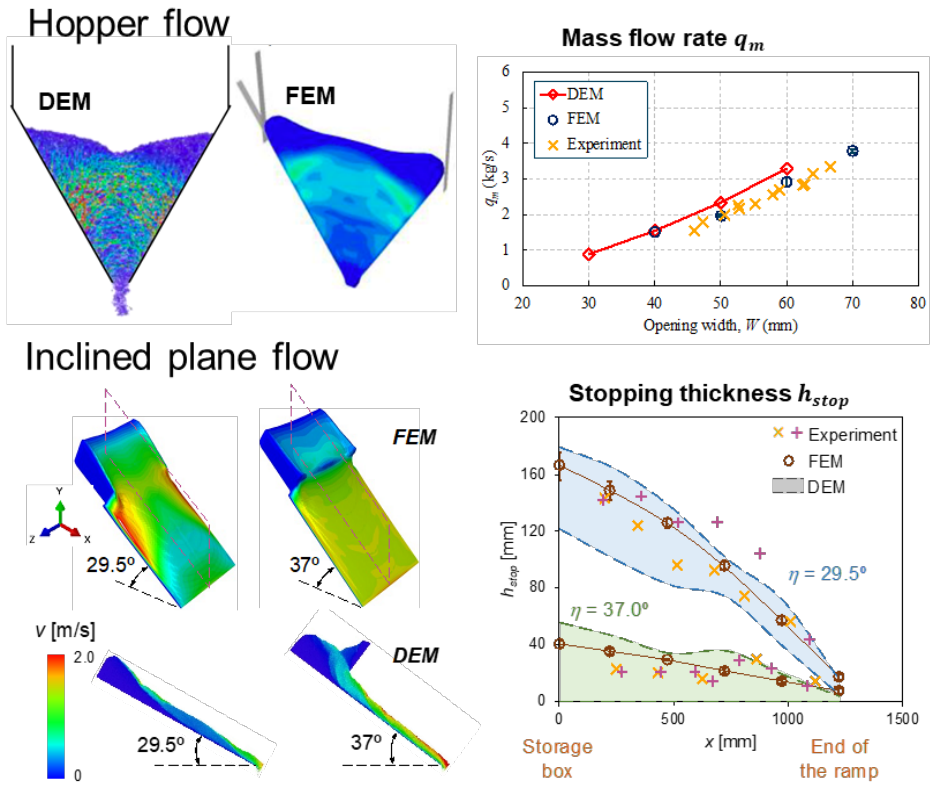


Example Capabilities (3)

Tools to Predict the Flow of Biomass

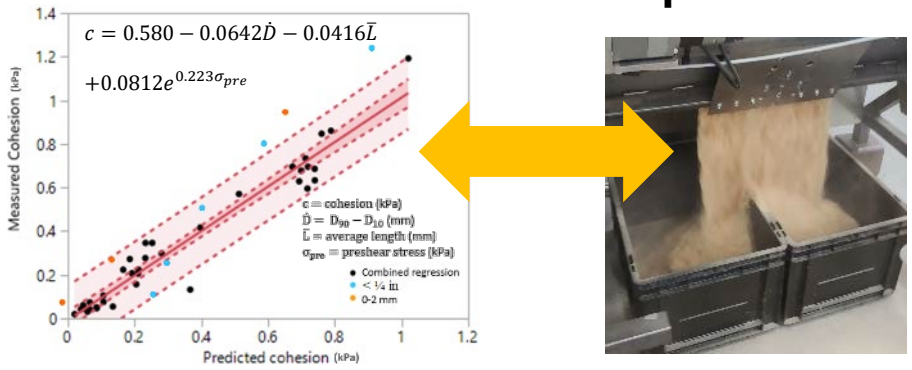
https://www.energy.gov/eere/bioenergy/fcic-materials-handling-research#outcomes

DEM & FEM Models for Milled Pine Flow

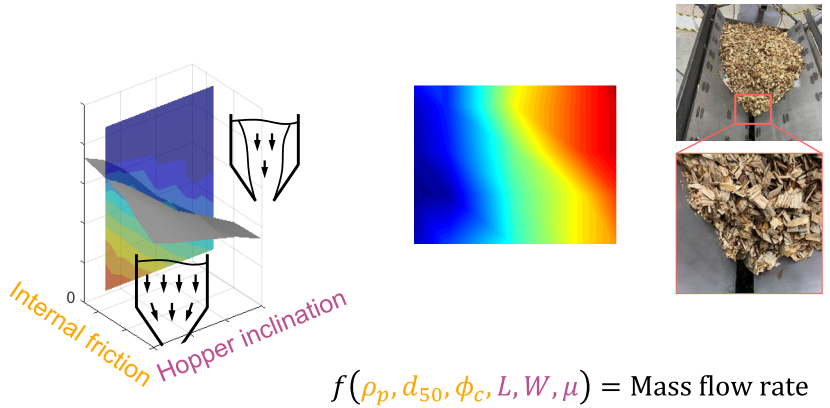


https://github.com/idaholab/GranularFlowModels

Relate Material Attributes to Shear and Bulk Flow Properties



Wedge Hopper Design Chart



$f(\rho_p, d_{50}, \phi_c, L, W, \mu)$ = Mass flow rate

FY25 Industry Partnership Call

- The IPC will have 3 Topic Areas
  - Topic Area 1 – Cooperative Research and Development Agreement (CRADA) Partnerships
  - Topic Area 2 - Rapid Technical Assistance
  - Topic Area 3 - Biorefinery Technical Assistance
- Topic Area #1 requires a CRADA
- Topic Areas #1 and #3 require cost-share

- **All funding will go directly to the national laboratories**

Topic Area 1: CRADA Partnerships

- Intended to partner industry stakeholders with **one or more** national laboratories associated with the FCIC.
- The **CRADA** will identify background intellectual property (IP) for all involved parties and will protect any IP developed during the project.
- The applicant must commit a minimum of **20% cost share** to the project, which can include in-kind or cash.
- Projects are targeted to have a federal share of $400K - $2MM and last up to **36 months.**

Same structure/approach as the 2023 CRADA Call

FCIC 2023 CRADA Call Awarded 7 Projects - $4.4MM

- 3 projects were awarded in August 2023 **($2.18MM)**
  - **AMP Robotics** (characterization of processed MSW streams)
  - **Rawlings** (wear mitigation in Wood Hog Grinders)
  - **Warren & Baerg** (MSW de-baler head design/construction)
- 4 additional projects were awarded in May 2024 **($2.18MM)**
  - **Alder Renewables** (characterization of stabilized py-oils)
  - **Novastus** (modeling novel MSW dryer)
  - **West Biofuels** (modeling/experimental work on forest waste gasification)
  - **Verde Nanomaterials** (low-cost alternative to nanocrystalline cellulose)

https://www.energy.gov/eere/bioenergy/us-department-energy-selects-seven-projects-help-industry-leverage-fcic-capabilities

Topic Area 2: Technical Assistance Projects

- Intended to provide industry stakeholders with **rapid technical assistance** from **one** national laboratory associated with the FCIC.
- Projects will not generate IP and therefore **do not require a CRADA**.
- **No cost share** required.
- Projects are targeted to launch quickly, have a federal share of $50K – $150K, and last up to **6 months**.

Topic Area 3: Biorefinery Technical Assistance Projects

- Intended to **support current biorefineries** with rapid process design or operational troubleshooting from **one or more** national laboratories associated with the FCIC.
- This opportunity is available to pilot-, demonstration-, or commercial-scale biorefineries in the **planning, design, or operating phases**.
- **Projects will not generate IP and therefore do not require a CRADA.**
- Applicants must provide substantial involvement and commit a minimum of **50% in-kind cost share to the project**.
- Projects are targeted to have a federal share of $200K - $750K and last up to **24 months**.

Summary of IPC Categories

Topic Area	Max Duration (months)	Total Federal Share per project	Minimum Cost Share	CRADA Required?
1: CRADA Partnerships	36	$400K - $2MM	20% (in-kind or cash)	Yes
2: Technical Assistance	6	$50K - $150K	None	No
3: Biorefinery Technical Assistance	24	$200K - $750K	50% (in-kind)	No

Eligible Feedstocks

- **Lignocellulosic biomass** refers to agricultural or forestry residues and purpose-grown crops.
- **Oilseed crops** refer to U.S.-produced, oil producing crops including, but not limited to, soybeans, cottonseed, sunflower seed, canola, rapeseed, peanuts, camelina, carinata, pennycress, and oil-producing annual cover crops.
- **MSW** refers to the non-recycled portion of MSW. Specifically, the focus is the organic portions of MSW that can be converted to biofuels/bioproducts, including non-recycled paper, plastic, rubber and leather, textiles, wood, food waste, and yard trimming constituents of the MSW stream, and the relevant contaminants that could affect conversion of the feedstock to a fuel or product. It also includes the non-recycled material discharged from Material Recovery Facilities (MRF) that is ordinarily sent to a landfill.
- **Organic waste** refers to food waste from industrial, commercial, and residential sources, primary, secondary, tertiary, and post-anaerobic digestion sludge (i.e., biosolids) from municipal wastewater treatment systems, animal manure, and fats, oils, and greases (FOG).
- **Food waste** refers to food from industrial, commercial, and residential sources that is no longer suitable for human consumption, and which would have otherwise entered an anaerobic digester, landfill, or other post-consumer disposition.

Eligible Unit Operations

Eligible Unit Operations

- Any unit operation(s) that occur after the initial collection of the feedstock
  - For projects involving **lignocellulosic biomass and oilseed crops**, all unit operations after harvesting, up to and including eligible conversion unit operations
  - For projects involving **MSW** and **organic wastes**, all unit operations after the initial collection of the material up to and including eligible conversion unit operations

Eligible Conversion Processes

- Both **low-temperature processes** (e.g., pretreatment, enzymatic hydrolysis, microbial conversion, anaerobic digestion) and **high-temperature processes** (e.g., pyrolysis, gasification, hydrothermal liquefaction)

Eligible Conversion Products

- **Finished biofuels (both liquid and gaseous), bioproducts, and intermediates** that can be converted to finished biofuels or bioproducts through additional unit operations

More Details

Proposer Eligibility

- Applicants for all topic areas must be a for-profit or nonprofit entity.
- Institutions of higher education are **not** eligible to apply.
- All proposals must provide an up-to-date Unique Entity ID (UEI) from System for Award Management (SAM).
- Individual U.S. citizens and lawful permanent residents
- Foreign entities (**but must receive approval from DOE if selected**)

Project Costs

- All federal funds will be spent by one of the national laboratories in the FCIC
- No funds will “pass-through” to partner organizations
- Partner organizations cost-share requirements depend on the Topic Area

Industry Partnership Call Timeline

Date	Event
Sep 16, 2024	Informational Webinar
Nov 1, 2024	Notice of Intent **Deadline**
Nov 15, 2024	Applicant Presentation **Deadline**
Dec 6, 2024	Proposal Submission **Deadline**
Jan-Feb, 2025	Project Proposal Review
Mar 5, 2025	Announcement of Selections
October 2025	Anticipated Project Kickoffs

Step 1. Send a Notice of Intent

- A notice of intent is required by **November 1, 2024**
  - Email FCIC@nrel.gov with the following information: Name, organization, email, topic area, and proposed national lab partner (if you know which national lab you would like to work with).
  - You will receive a confirmation of receipt email within 1 working day.
- Prior to submitting a notice to propose a project under Topic Area #1, please read the terms of the Cooperative Research and Development Agreements (CRADA). This has been reviewed and approved by most participating DOE labs. This template will be used for all Topic Area #1 projects and is **non-negotiable**.

Step 2. Meet with FCIC Researchers

- All applicants to Topic Areas #1 and #3 will be required to give a short presentation on the proposed project, using the FCIC IPC presentation template.
- The presentation should be no longer than 20 minutes and the applicant should be available for up to an additional 20 minutes to answer questions. Applicants will receive an email to schedule presentations.
- Based on this preliminary presentation, applicants will be encouraged or discouraged to provide a full proposal submission. This feedback will be provided via email within five working days after the applicant presentation.
- If a proposal is encouraged, applicants will be partnered with a laboratory and FCIC researcher to assist with developing the proposal.
- Applicants for Topic Area 2 are not required to give a presentation but may contact FCIC@nrel.gov with any questions regarding the proposal.

Step 3. Develop a Proposal

- Use the proposal template that corresponds with the selected topic area to develop your proposal:
  - IPC Topic Area 1 Template
  - IPC Topic Area 2 Template
  - IPC Topic Area 3 Template

- **Read the proposal templates carefully to ensure you are following all instructions, including the required cost share and total proposal length, which varies by Topic Area.**

- **Read the scoring rubric for guidelines to help prepare an effective proposal.**

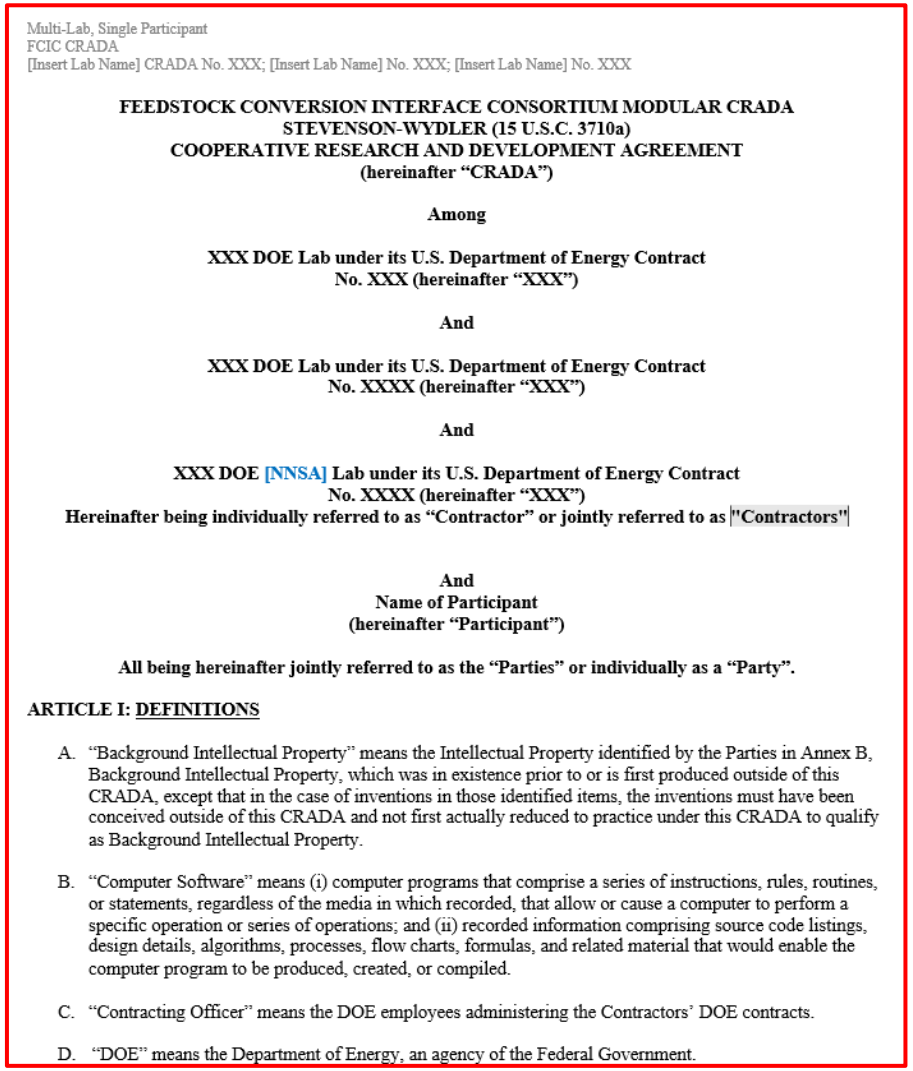
Step 4. Submit

Submit your completed proposal to FCIC@nrel.gov no later than 11:59 p.m. MT, December 6, 2024.

Note: FCIC and BETO will use the information provided in the proposal for the review process. They will not share this information for any other purpose, and it will be retained indefinitely. See DOE's security and privacy policy.

Contractual Information – the CRADA

- Successful applicants to Topic Area #1 must sign a Cooperative Research and Development Agreement (CRADA) with the partnering national laboratory **prior to project start**.
- Terms of the CRADA are **non-negotiable**
- **Applicants are strongly encouraged to review the example CRADA document carefully.**



Multi-Lab, Single Participant
FCIC CRADA
[Insert Lab Name] CRADA No. XXX; [Insert Lab Name] No. XXX; [Insert Lab Name] No. XXX

FEEDSTOCK CONVERSION INTERFACE CONSORTIUM MODULAR CRADA
STEVENSON-WYDLER (15 U.S.C. 3710a)
COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENT
(hereinafter "CRADA")

Among

XXX DOE Lab under its U.S. Department of Energy Contract
No. XXX (hereinafter "XXX")

And

XXX DOE Lab under its U.S. Department of Energy Contract
No. XXXX (hereinafter "XXX")

And

XXX DOE [NNSA] Lab under its U.S. Department of Energy Contract
No. XXXX (hereinafter "XXX")
Hereinafter being individually referred to as "Contractor" or jointly referred to as "Contractors"

And
Name of Participant
(hereinafter "Participant")

All being hereinafter jointly referred to as the "Parties" or individually as a "Party".

ARTICLE I: DEFINITIONS

A. "Background Intellectual Property" means the Intellectual Property identified by the Parties in Annex B, Background Intellectual Property, which was in existence prior to or is first produced outside of this CRADA, except that in the case of inventions in those identified items, the inventions must have been conceived outside of this CRADA and not first actually reduced to practice under this CRADA to qualify as Background Intellectual Property.

B. "Computer Software" means (i) computer programs that comprise a series of instructions, rules, routines, or statements, regardless of the media in which recorded, that allow or cause a computer to perform a specific operation or series of operations; and (ii) recorded information comprising source code listings, design details, algorithms, processes, flow charts, formulas, and related material that would enable the computer program to be produced, created, or compiled.

C. "Contracting Officer" means the DOE employees administering the Contractors' DOE contracts.

D. "DOE" means the Department of Energy, an agency of the Federal Government.

FAQs

Will these slides be posted?

- These slides and a recording of the webinar will be posted on the website

Will funding be available to companies?

- All federal funds under this program will be spent by researchers at FCIC member national laboratories

Can I submit multiple proposals?

- Yes, provided the requests are unique and distinct

FAQs

What is cost share?

- Cost share principles are available in 2 CFR 200.306: https://www.ecfr.gov/current/title-2/subtitle-A/chapter-II/part-200/subpart-D/section-200.306. In-kind cost share (such as technical consulting/expertise, or use of equipment) is allowed as is cash cost share

How is cost share calculated?

- Cost share is calculated based on the total project cost (not just the federal share). For example:
  - A project is requesting $400K of federal support for Topic Area #1, which requires 20% cost share
  - A minimum cost share of $100K would be required. $100K is 20% of $500K.

What if I have other questions?

- Please visit the website to view our current list of FAQs. If your question has not been answered, please submit them to **FCIC@nrel.gov**

Questions?

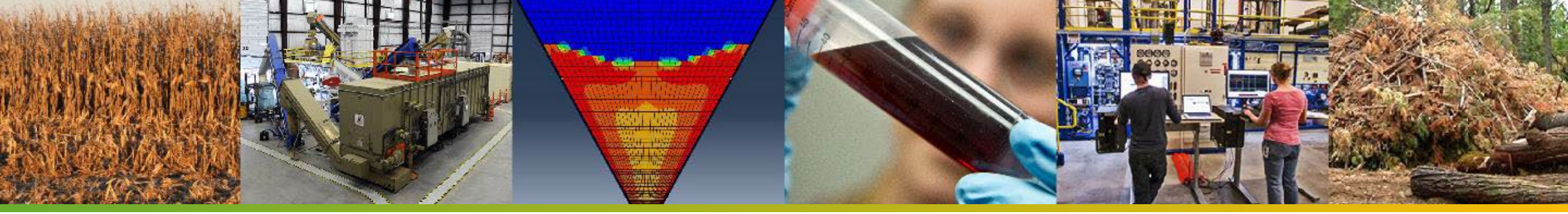
Ben Simon
Technology Manager, BETO
Ben.Simon@ee.doe.gov

Ed Wolfrum
Principal Investigator, FCIC
Ed.Wolfrum@nrel.gov

More about this Industry Partnership Call

https://www.energy.gov/eere/bioenergy/fcic-fy25-industry-partnership-call

Industry Partnership Call Contact: FCIC@nrel.gov



Thank you

http://energy.gov/fcic

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