



U.S. DEPARTMENT
of **ENERGY**

Office of Critical Minerals
and Energy Innovation

Alternative Fuels and Feedstocks Office

Thermochemical Pathways to Support AFFO's Priorities

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AFFO Overview

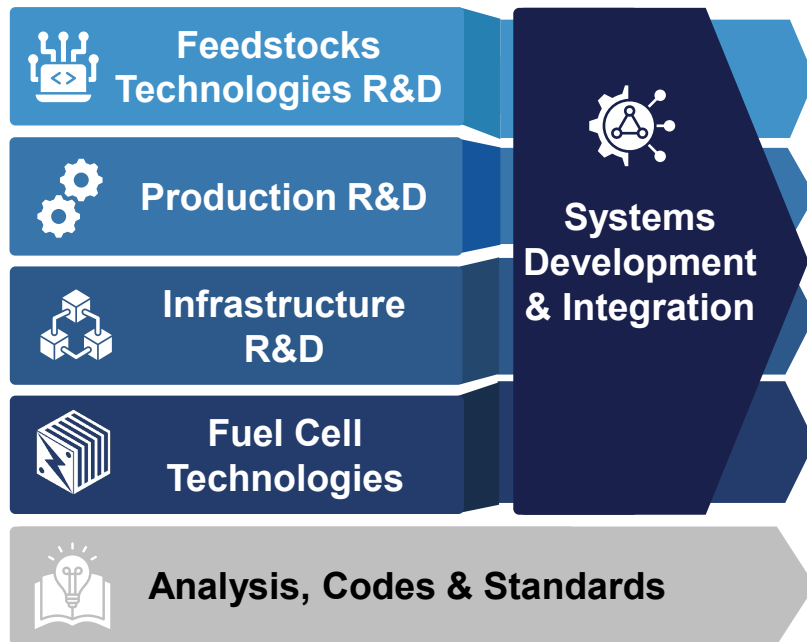
AFFO Subprograms

— support →

AFFO Mission

— drives →

AFFO Priorities



Advancing technologies that mobilize America's abundant potential for biomass and hydrogen, to:

- Enhance domestic production of fuels, chemicals, and materials
- Enable affordable and reliable energy choices for businesses and consumers

AFFO pursues its mission through five strategic priorities:



Recent AFFO Lab and CRADA Calls



of Awards

**Feedstock Logistics and
Preprocessing Technologies**

4 – 8

**Biobased Fertilizer from Bioenergy
Systems** (Terrestrial and Algae)

4 – 7

Material Based Fertilizer R&D

3 – 5

Material Based Fertilizer Production
(CRADA Call: Cost Share 20%)

2 – 4

Fertilizer Supply Chain Analysis

0 – 1

Wood Heaters
(CRADA Call: Cost Share 20%)

2 – 4

**Process R&D for Chemicals
Production**

8 – 10

**Strategic Analysis for U.S. Chemical
Production**

3 – 5

Renewable Propane TEA and R&D

0 – 1

**Gasification Gas Clean-up and
Syngas-to-Products**

0 – 2

Process Development Unit Partnerships
(CRADA Call: Cost Share 20%)

4 – 6

Algae Data Center Analysis

0 – 1

Recent AFFO Lab and CRADA Calls



of Awards

Geologic Hydrogen R&D

0 – 1

Geologic Hydrogen Validation (CRADA Call: Cost Share 20%)

3 – 6

Data Center Fuel Cell Solutions (CRADA Call: Cost Share 30%)

5 – 8

Critical Minerals, Genesis Mission

2 – 4

Critical Minerals, Electrochemical R&D

2 – 4

H2Nuc R&D for Nuclear Integration

0 – 1

Nuclear Integration at Proving Grounds (CRADA Call: Cost Share 20%)

3 – 5

Thermochemical Capabilities

Flexibility

Gasification

Recent/Historical Approach: Can we make clean syngas efficiently enough to make fuels?

Potential:

- Make specification-grade building blocks for platform chemicals, catalysis R&D
- Syngas with composition, purity, pressure, and cost required by a particular downstream process
- Nutrient and/or critical material recovery from char

What's Holding Us Back: Gas clean-up costs, reliable reactor feeding, feedstock variability



Nuclear integration?

- Excess heat to gasifier
- Excess steam for bed fluidization
- Dry or torrefy incoming biomass

Syngas Clean-Up and Upgrading, Lab Call

Focus

Innovations that advance gas clean-up technologies to enable gasifiers to meet the needs of growing chemical markets

Selection

Advanced Nanoceramic Syngas Conditioning (ANSC): A Physics-Guided, Regenerable Monolith for Integrated Cleanup of Real Biomass Syngas

Goal

≥90% tar reduction, ≥90% H₂S/COS



Hydrocarbons and Geothermal Energy
Office (HGEO, formerly FECM)



Evaluating feedstock blends
(MSW, biomass, and coal)

Pyrolysis

Recent/Historical Approach: How do we increase bio-oil production yield, lower oxygen content, and hydrotreat into fuels?

Potential:

- Leveraging biomass chemistry (oxygen) to make chemicals
- Alternative feedstocks (plastics, tires, etc.)
- Integrating with petrochemical facilities
- Mild upgrading for other end-uses
- Bio-coke / carbon black products (graphite / critical materials)

What's Holding Us Back: Bio-oil chemistry, yield, feedstock variability, stability, separations



PDU Partnerships, CRADA Call

Focus

Leverage the Process Development Units (PDUs) operators and equipment to scale and partner with industry



**National Laboratory
of the Rockies**

Selection

Fast Pyrolysis Platform for Domestic Chemicals, Fertilizers, and Materials

Goal

- Advancing biocoke-based IP by producing metallurgical biocoke
- Valorizing light bio-oil stream for polymer intermediates
- Biocrude for performance enhanced carbon black production
- Biochar for slow-release nutrient-loaded fertilizers



Hydrothermal Liquification

Recent/Historical Approach: Can we hydrotreat biocrude to produce SAF and renewable diesel? Dispose of the other streams?

Potential:

- Whole product valorization (NPK, CM, etc.)
- Concentrate nutrients in the solids phase
- Petrochemical refinery integration
- Treating contaminants of concern

What's Holding Us Back : Continuous time on stream, pressure letdown, phase separation, heavy metals in biocrude



HTL Innovations

- New Feedstocks: Lignocellulosics and e-waste
- FIRE FUEL: Wildfire thinnings utilization and recycling the aqueous phase to format the feedstock
- Bench-scale R&D: Fertilizer recovery from aqueous phase and critical materials from solid phases
- Regulatory Potential: PFAS destruction



HTL Deployment Roadmap
Coming Soon!!



Torrefaction

Recent/Historical Approach: Small R&D portfolio, biochar as soil amendment

Potential:

- Torrefy and grind for entrained flow reactor feeding
- “Base” for enhanced fertilizer/soil amendment
- Alternative carbon source

What's Holding Us Back: Product valorization, product testing, suppliers



Biobased Fertilizers, Lab Call

Focus

Develop new pathways that utilize terrestrial biomass or resource recovery to produce nutrient enhanced biobased fertilizers

Selection

Harnessing and enhancing waste nutrient resources via biochar-based slow-release fertilizers from terrestrial biomass

Goal

Hydrothermal carbonization of woody and wet wastes to develop and test a slow-release NPK biochar



PDU Utilization, CRADA Call

Focus

Leverage the Process Development Units (PDUs) operators and equipment to scale and partner with industry

Selection

Torrefaction of Biobased Feedstocks to Produce Chemically Enhanced Biochar Cement Composites

Goal

Demonstrate ≥ 20 tons of pilot-scale material in multi-site concrete field trials, targeting a 20% increase in compressive strength



Looking Ahead

Strategy Refinement

Gasification

syngas, hydrogen, fertilizer (ammonia) intermediates, critical material recovery, chemicals (methanol), fuels, and power

Pyrolysis

hydrogen, stabilized bio-oils, fractionated bio-oils, engineered biochar, biocoke, and other co-products, chemicals and fuels

Hydrothermal Liquefaction

biocrudes, fractionated biocrudes, fertilizer recovery, chemicals, fuels, and destroying contaminants of concern (PFAS)

Torrefaction

feedstock stabilization, densification, engineered biochar, biocoke, and solid carbon products

Cross-Cutting

Preprocessing, reactor feeding, carbon efficiency, separations, process intensification, and co-product valorization

Strategy Refinement

Hub and Spoke Depots

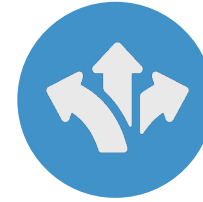
- Create stable intermediates to densify biomass and wastes more regionally
- New waste feedstocks like plastics and tire pyrolysis oils
- Supporting forthcoming analysis from National Labs

Petrochemical and Refinery Integration



- Understand impact of alternative intermediates in existing pilot plants

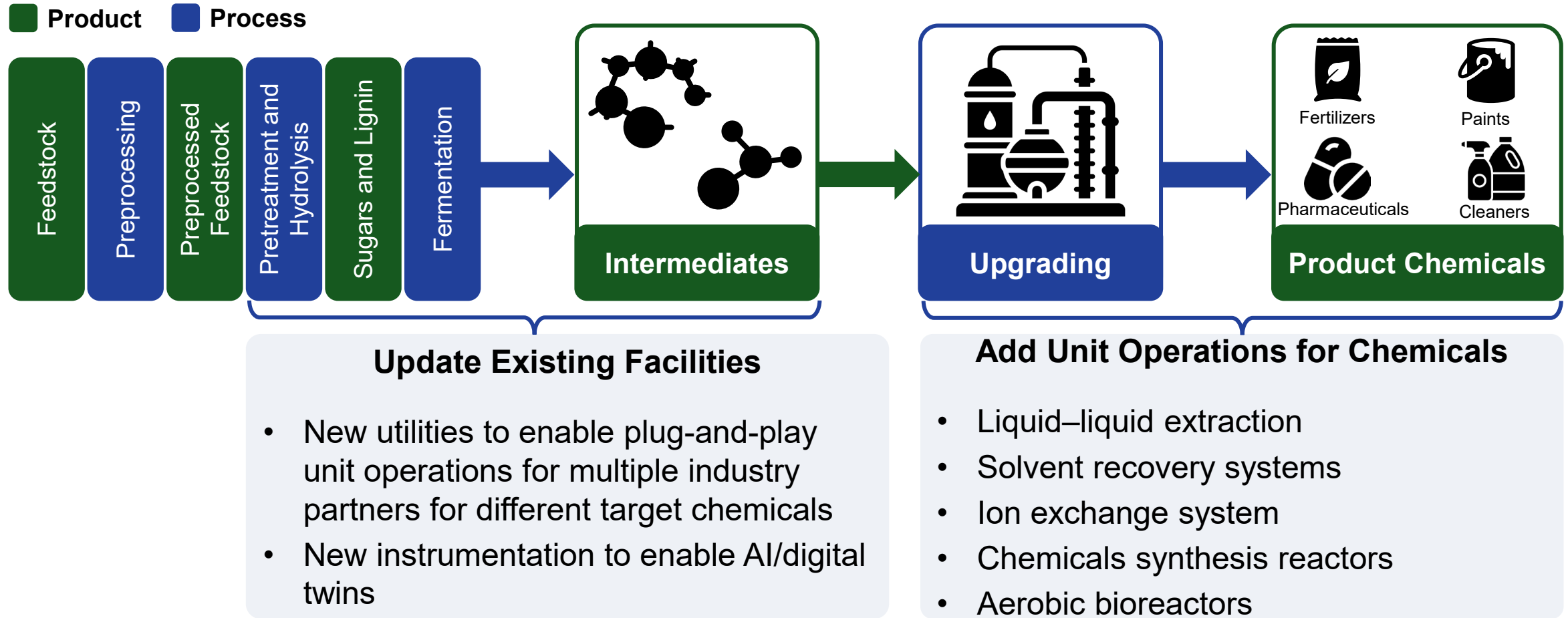
Gas Distribution Infrastructure



- Leverage existing pipelines for gas or gaseous intermediate distribution

Upgraded National Lab Facilities

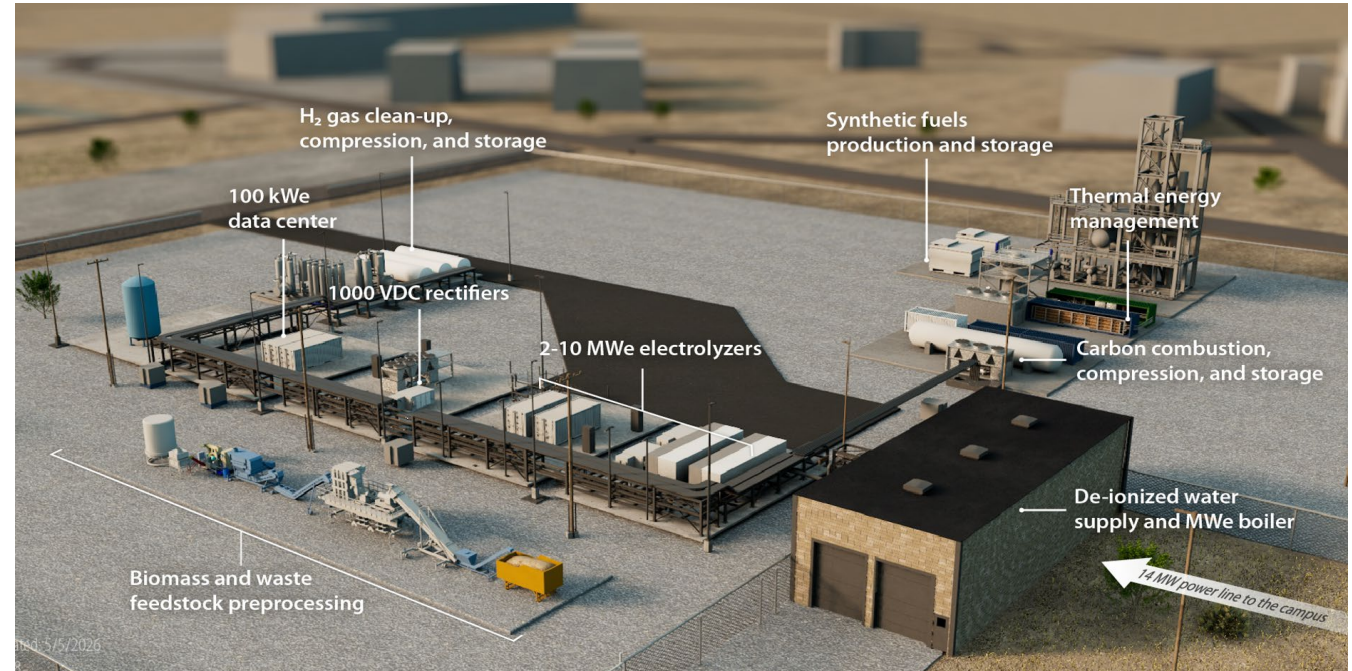
NLR, \$20M Facility Upgrade (IBRF)



NLR, \$20M Facility Upgrade (IBRF)



INL, >\$90M Proving Ground



Let's Work Together

\$58M Notice of Intent

Accelerating Scale-up and Pre-piloting of Emerging Chemical Technologies (ASPECT)

First Chemicals Funding Under the Office of Critical Minerals and Energy Innovation

Highlights

- Up to \$58M potential federal investment
- Strengthening U.S. manufacturing
- Supports domestic supply chains
- Accelerates commercialization of emerging chemical technologies

Funding Topic Areas

Bench ASPECT

- Advance technologies from proof-of-concept to bench/pre-pilot scale

Pre-Pilot ASPECT

- Accelerate pilot development and market readiness

GOAL: Increase the TRL of four (4) to eight (8) novel technologies and pilot at least one (1) technology to increase speed to market of emerging chemicals

Stay Connected with AFFO



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*Alternative Fuels and
Feedstocks Office*



Apply to AFFO/DOE Funding
Opportunities

- [Notice of Funding Opportunities](#)
- [Partnership Intermediary Agreements](#)



Attend DOE/AFFO events,
workshops & webinars

 [Peer Review Meeting](#)
Week of April 19, 2027 



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Thank you

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