U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Andrea Bailey

Technology Manager

Data, Modeling, and Analysis

April 3-5, 2023

DMA Overview

1. Overview of the DMA session
2. DMA Strategy
   - Goals and Targets
   - Portfolio Organization and Management
   - External Engagement
3. DMA Progress
   - Response to 2021 Review
   - Changes in BETO Analysis Strategy
   - Recent Successes and Future Work

Agenda Overview

Monday AM	BETO Plenaries
Monday PM	Full Bioenergy Supply Chain Models and Tools
Tuesday AM	Landscape Management and Ecosystem Services Models, Tools, Field Studies
Tuesday PM	LCA and Sustainability Modeling
Wednesday AM	LCA and Sustainability Modeling + Analysis of Hard to Decarbonize Transportation Sectors
Wednesday PM	Community Engagement Work and DEI Related Analysis

- The review panel will be given the first opportunity to ask questions at the end of each presentation before we move to the audience
- We will hold of starting presentations until their agenda start time rather than get ahead of schedule in case there are people looking to attend a particular presentation.
- Each day will end with a closed door session between BETO and the review panel

Reviewer Introductions

Name	Affiliation
Nikita Pavlenko	ICCT Fuels Team
Chris Ramig	EPA
Jason Jones	ICF
Sarah Mittlefehldt	Northern Michigan University
Yalin Li	University of Illinois Urbana-Champaign
Steele Lorenz	Farmers Business Network

BETO Introductions

Data, Modeling, and Analysis Team (DMA Team)

Jay Fitzgerald
Chief Scientist,
Program Manager, DMA
Biotech, Plastics, Chemicals,
Program Strategy

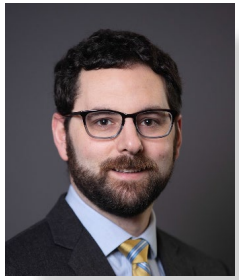
Andrea Bailey*
Technology Manager
Sustainability,
Analysis, Budget,
Design Cases

Zia Haq
Lead Analyst
Policy Analysis
SAF Grand Challenge

Michael Shell
Technology Manager
Modeling, Land Use,
Lifecycle Assessment

Bryce Finch*
BCS
Project Monitor

Andrew Zimmerman
BCS – 50% DMA
Portfolio Analysis and
Policy



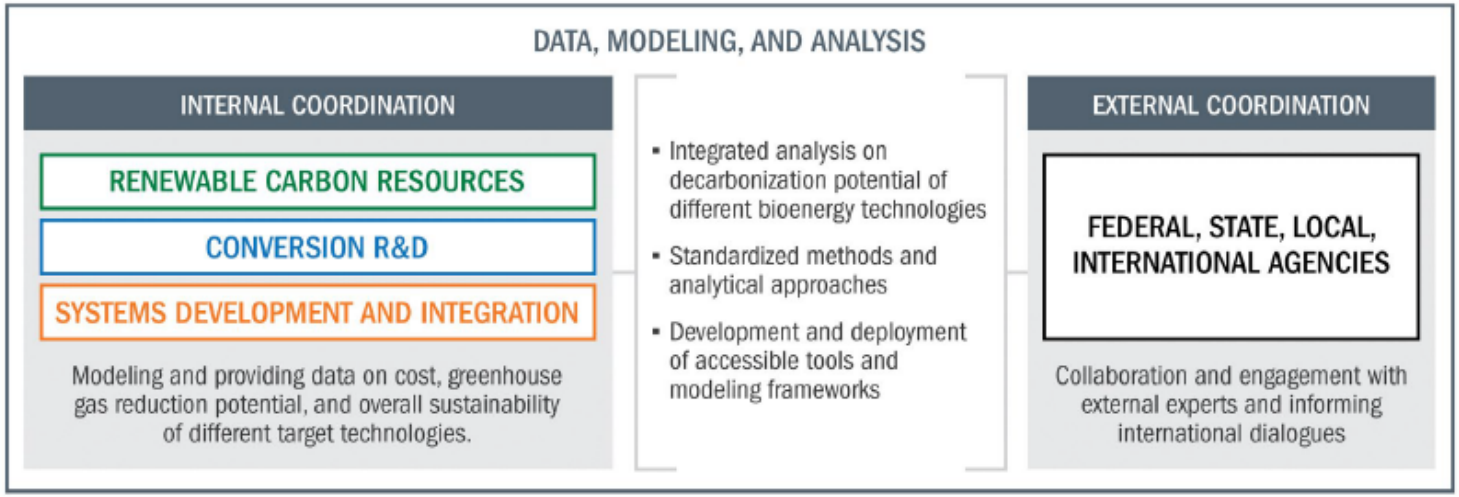
Simon Roberts
Redhorse - 50% DMA
Business Support and
Engagement

Bri Farber
BGS –50% DMA
Joint Office
Priorities and JEDI

***Main Peer Review POCs**

DMA Strategy – Goals and Targets

The strategic objective of the DMA subprogram is to develop and deploy accessible modeling frameworks and tools to enable quantification of the environmental, social, and economic sustainability of renewable carbon resource utilization.



DMA supports all five of BETO's performance goals and coordinates closely with the three other subprograms on developing cost, performance, and sustainability goals for specific feedstocks and technologies as needed.

DMA Strategy – Goals and Targets

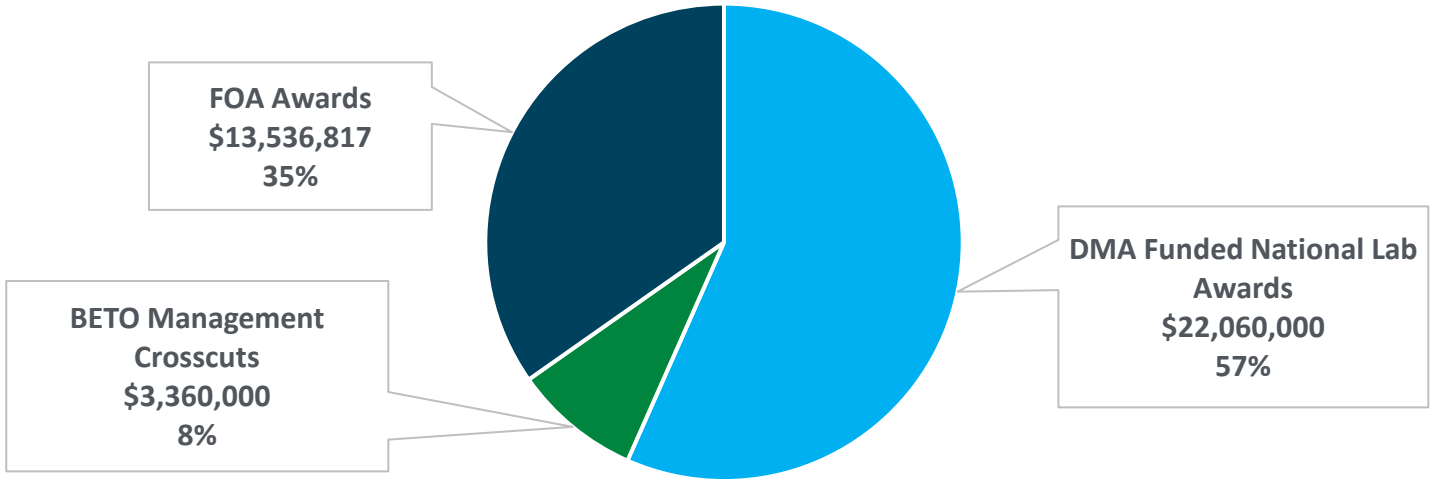
- Plays a prominent role in assisting BETO subprograms with assessing progress towards GHG and other sustainability goals
  - SAF Grand Challenge fuels should achieve a minimum of a 50% reduction in life cycle GHGs compared to conventional fuel
- Assists BETO in making strategic decisions about near term vs. long term goals and targets
  - Under what economic and technical scenarios can we meet the SAF GC goals
  - Determining the best use of biomass to maximize different end outcomes
- Interfaces with other DOE teams and other Federal Agencies to unify assumptions in analysis across bioenergy spaces

DMA Strategy – Portfolio

26 total project presenting in this session

- 5 Competitively awarded through the FOA process
- 18 National Lab awards funded by DMA
- 3 National Lab awards that address BETO Management Crosscuts

Three additional National Lab projects were awarded in October 2022 but will not present since they only started work in the last 6 months.



*Budget numbers presented here represent full project budgets for competitive awards and budget awarded in FY21-23 for National Lab projects

DMA Strategy – Portfolio and Management

Projects are roughly separated into the following three bins:

Strategic Bioenergy Analysis	10 Projects	$11,790,000
Analysis of the Sustainability of Bioenergy	8 Projects	$9,775,000
Land Use and Landscape Design*	8 Projects	$17,391,817

*Budget numbers presented here represent full project budgets for competitive awards and budget awarded in FY21-23 for National Lab projects

Changes since the 2021 review:

- Most new feedstock fieldwork has moved to the Terrestrial Feedstocks portion of RCR
- Other platforms have increased funding towards sustainability analysis on specific targets such as SAF and plastics that complements work done by DMA, but will not be presented in this session
- Projects have been strongly advised to pivot existing tools and models so that they're able to support work in deploying SAF and maximizing decarbonization.

DMA Strategy – Portfolio and Management

- National Lab projects are typically awarded on a 3 year basis, though some projects will be 1 or 2 years long
- All projects proposals go through an external merit review and if selected are required to contain a mid-project go/no go milestone
- At the end of the originally agreed upon project end date, projects have the opportunity to propose continuation work based on lessons learned
  - You will hear from both brand new projects and projects that have recently been renewed during this review cycle

DMA Strategy – Portfolio and Management

Competitively awarded projects come from two solicitations:

1. **2019 – Reducing Water, Energy, and Emissions in Bioenergy**
   This topic provided funding for analysis projects that identify biofuel and/or bioproduct pathways with the greatest potential to reduce water consumption, energy consumption, and emissions relative to the current state of the art.
   - By the end of the project, selections will need to demonstrate an improvement in at least two of the following areas: water consumption, energy consumption, GHG emissions, other pollutant emissions
   - Awardees: University of California Berkeley, Colorado State University

Berkeley
UNIVERSITY OF CALIFORNIA

Colorado State University

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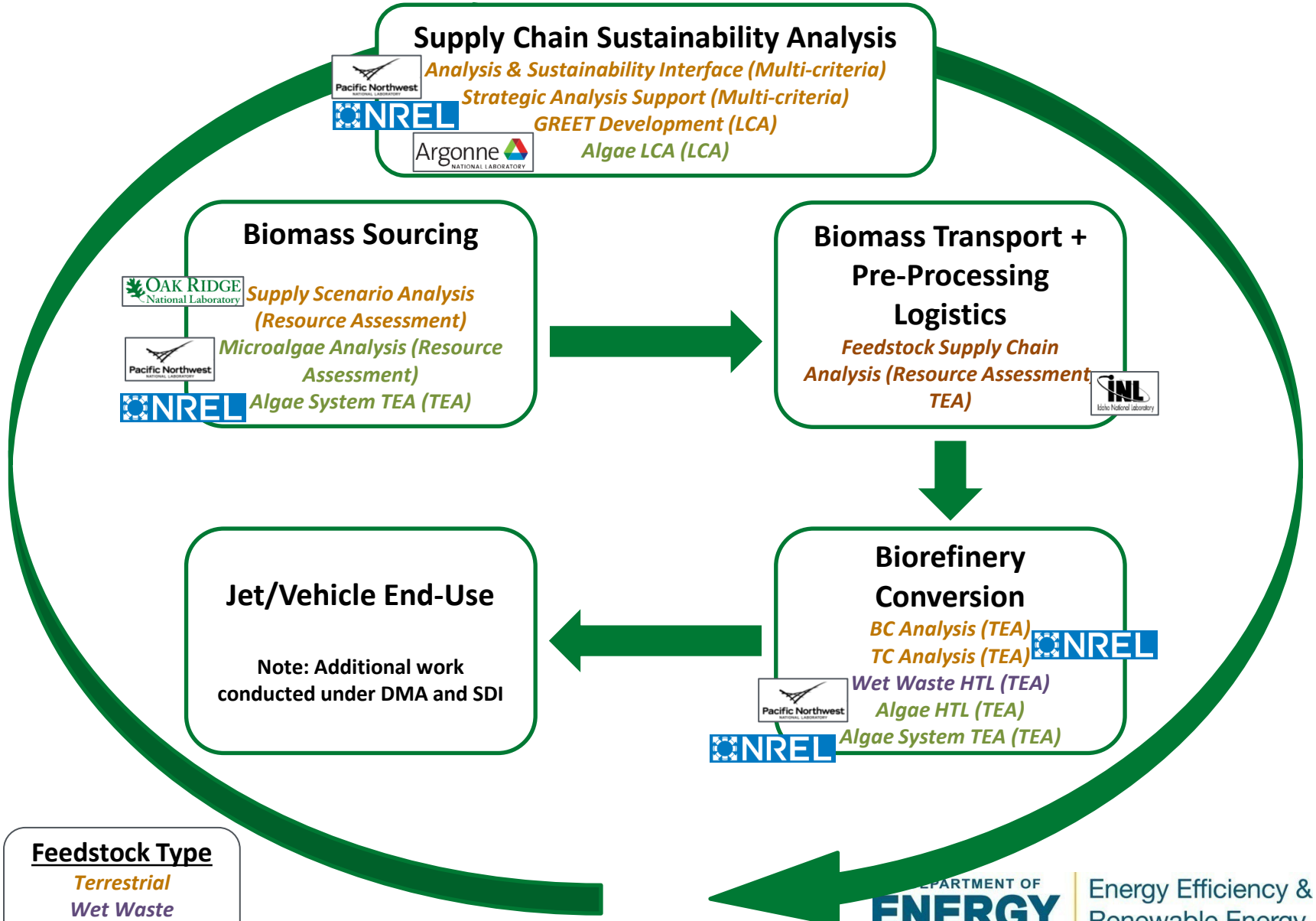
DMA Strategy – Portfolio and Management

2. **2020 – Bio-Restore: Biomass to Restore Natural Resources**
   This topic area was designed to fund field research to help quantify the ecosystem services associated with biomass production and/or harvesting.
   - Projects are required to address three main areas:
     - 1) targeting the appropriate places to produce or harvest biomass to deliver ecosystem services,
     - 2) measuring, verifying, and valuing those ecosystem services in a scientifically rigorous manner, and
     - 3) reducing uncertainty in modeled estimates of ecosystem services.
   - Awardees: Mississippi State University, University of Florida, University of Nebraska Lincoln

DMA Strategy – Portfolio and Management

- What you will not see in this review:
  1. ***Newly* awarded projects doing field work.** Office budgets have changed and new work in this area is primarily in the terrestrial feedstocks session.
  2. **A large number of projects awarded through the FOA process.** DMA has had a flat budget since before the 2021 review and responds to many DOE priorities with a short time frame meaning there has not been funding available to run a FOA. Most projects awarded by other subprograms have TEA and LCA requirements.
  3. **Projects working on the TEA of specific unit operations or upgrading pathways.** These projects are funded alongside the complementary experimental work by other subprograms.

DMA Strategy - Analysis Throughout BETO



DMA Strategy – Engagement

DMA helps create strong feedback loops with external stakeholders and assist leadership with external engagement:

- Assist with implementing the Bioeconomy Executive Order
- Coordinate with EPA on updated assumptions for the RFS Annual Rule
- Partner with CAAFI, FAA, USDA, DOT, and additional organization on how to implement the SAF GC Roadmap
- Participate in the GHG LCA Interagency Working Group to help standardize how the US government calculates and uses LCA data
- Provide technical assistance to DOE leadership on questions related to new legislation

DMA Progress – 2021 Review Recommendations

1. Harmonize across models within the BETO portfolio

- Work in this area since the 2021 review has focused on standardizing LCA assumptions across agencies, and better aligning TEA goals within BETO
- A workshop focusing on this area will be held in early Fall 2023

2. Continue/expand field research to ground-truth models and analyses

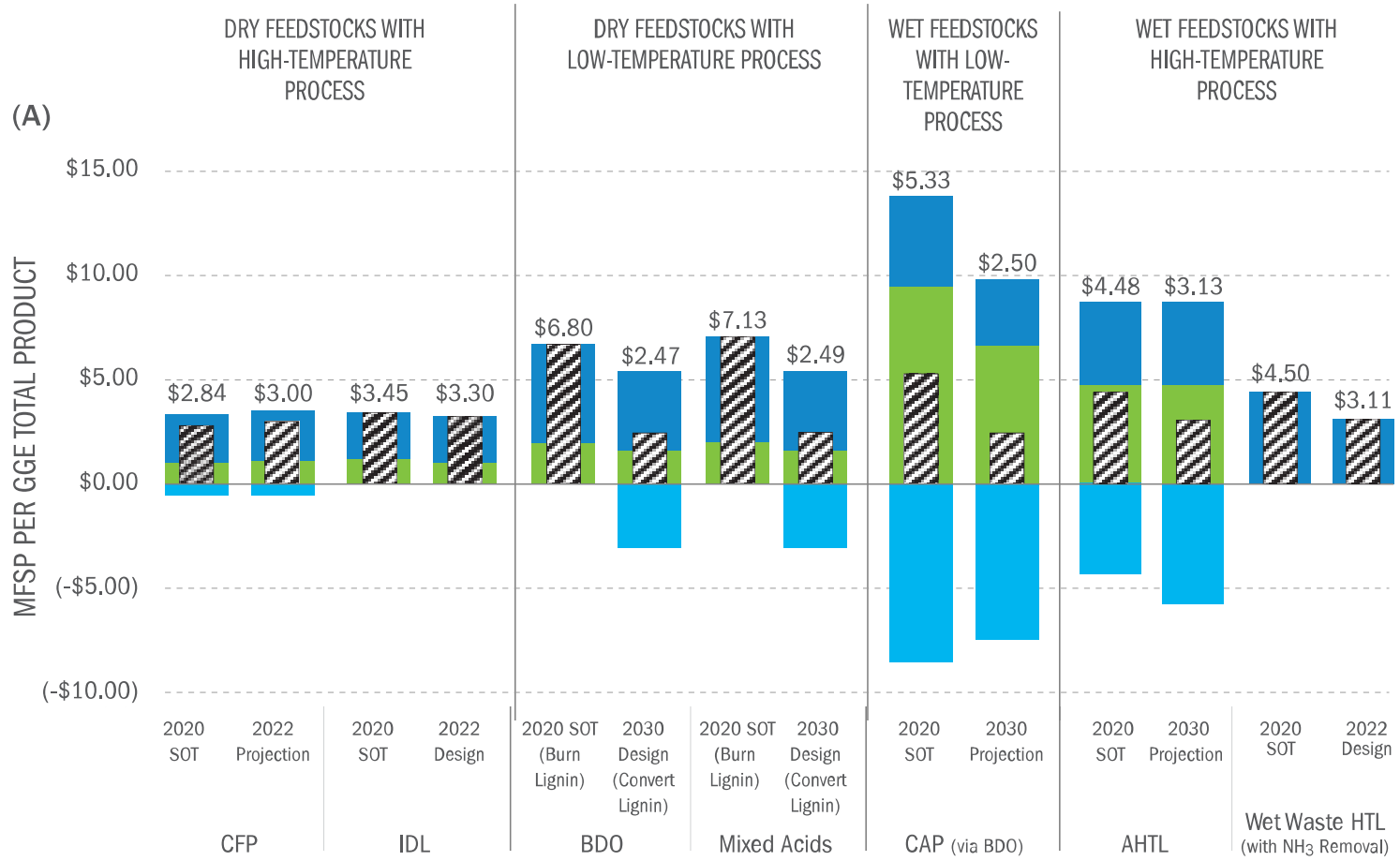
- BioRestore FOA awards will present in 2023 (did not present in 2021)
- Budget changes have also led to future work in this area being moved to the terrestrial feedstock portion of RCR.
- Overall Federal Budget has shifted work in this area to USDA as well (Climate Smart Agriculture program)

3. Increase support for social science research, including a focus on equity and justice

- Funded a joint project at ORNL/NREL that will present on Wednesday to examine BETO's work in this area and potential bioenergy DEI indicators.
- Do not view this work as complete but have begun investing.

DMA Progress – Changes in BETO-wide Analysis

Since the 2021 review, BETO has moved away from only using cost goals to track R&D progress. Previous research is shown below:



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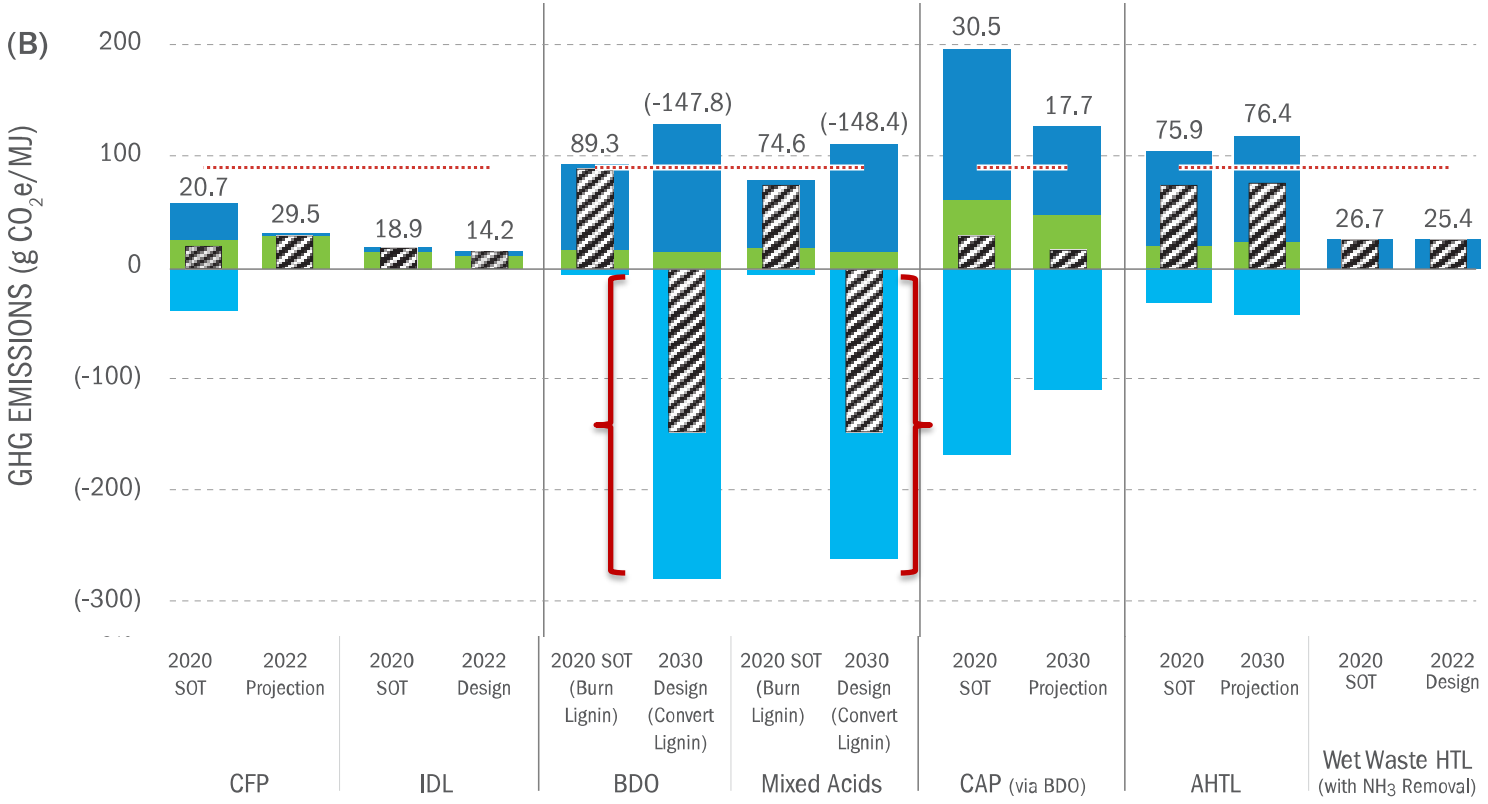
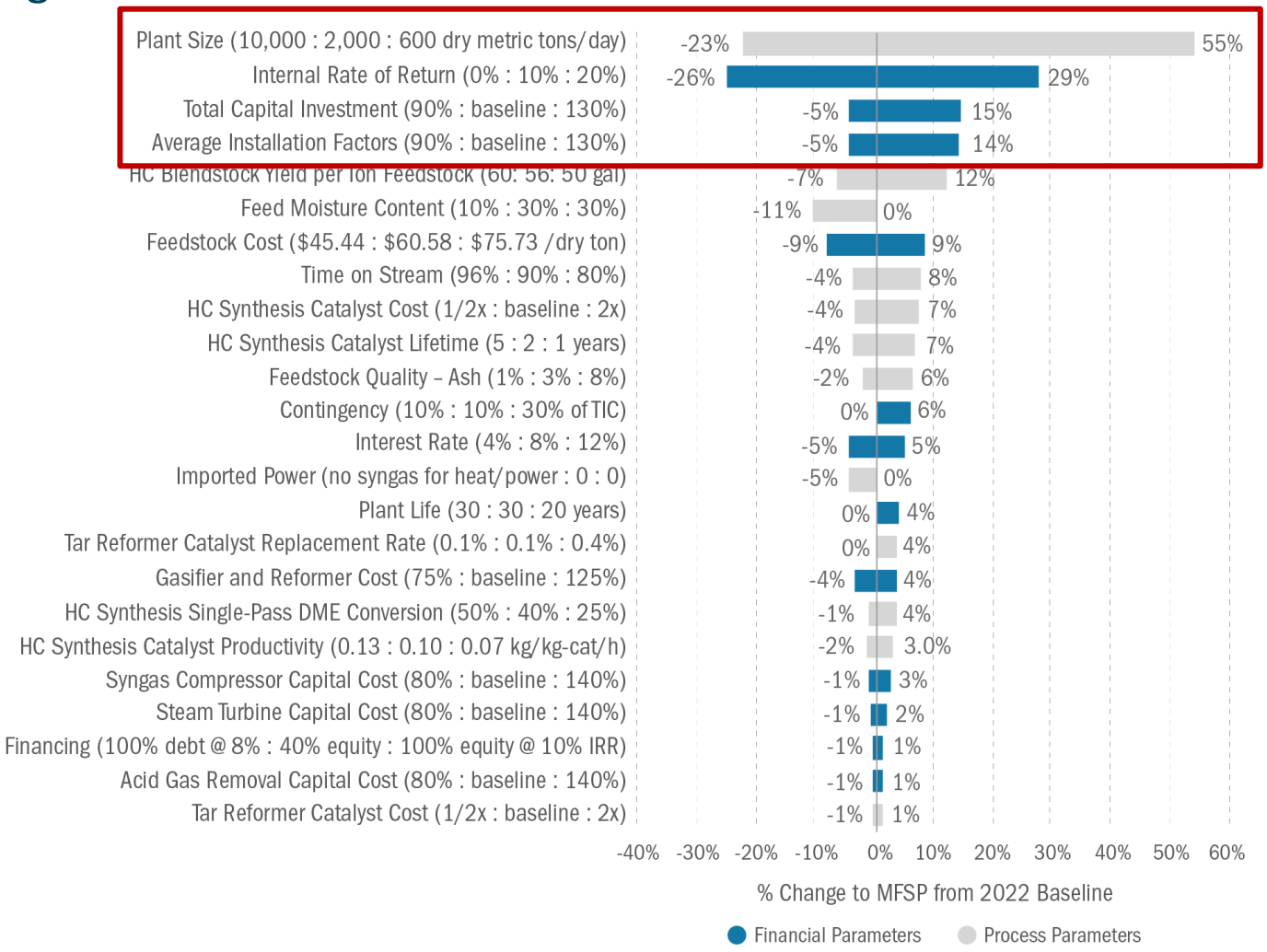
DMA Progress – Changes in BETO-wide Analysis

BETO previously tracked GHGs of a number of biofuel production pathways, but different assumptions made these numbers hard to compare:



DMA Progress – Changes in BETO-wide Analysis

Non R&D factors also played a large role in final fuel cost, making this a challenging metric to connect to BETO work:



DMA Progress – Changes in BETO-wide Analysis

BETO Design Cases & Updates

- Best estimate TEA & LCA of low to mid TRL pathways with significant BETO R&D investment
- Include some form of maturity and risk assessment
- Show improvement in a combination of MFSP + GHG and other impacts based on R&D advances

- As a result of the factors on the previous slides, since the 2021 review, the DMA team has worked with analysts across the bioenergy and renewable energy space, the national labs, and ran an industry-focused RFI.
- Based on this feedback, BETO is preparing to launch new TEA/LCA pathway analysis products to better match new goals and priorities

DMA Progress – Changes in BETO-wide Analysis

State of the Industry Report

- Focus on best estimate TEA & LCA of commercial/near commercial pathways
- Does not have to be a current focus of BETO R&D
- Does not have to improve year over year
- Will include maturity and risk assessments

- NREL project that began in October 2022 and will not present at this review
- Will focus on publishing TEA data on 4 commercial pathways to SAF.
  - HEFA (FY23 focus)
  - Fischer Tropsch
  - ATJ
  - Pyrolysis
- Potential partners include SAF producers, airports, airlines, and feedstock suppliers.

DMA Progress – Harmonizing Analysis Throughout BETO

Beginning in FY23, DMA is working with Analysis PIs to form a **BioEnergy Analysis & Strategy Team (BEAST)**

BEAST tasks:

1. Prioritization and sequencing of new Design Case Reports
   a) DMA worked with National Lab analysts to pick out new high priority pathways to publish deep dive design cases on in the next 18 months
2. Develop methods for inclusion of TEA and LCA data into other BETO analysis tools and models such as the Biomass Scenario Model.
3. Develop other harmonized assumptions for use in BETO analyses.

DMA Progress – Recent Successes & Future Work

GREET SAF Module and User Guide

- Argonne National Lab (ANL) is developing a Sustainable Aviation Fuel (SAF) specific GREET module and set of user guidance in support of the Tax credit (40B) and the Clean Fuel Production Tax Credit (45Z) from the Inflation Reduction Act.
- This GREET module will be an option for SAF producers to submit LCA data and thereby demonstrate eligibility for 40B with Treasury as well as determine the amount of the credit
  - 40B eligibility: 50% LCA GHG reduction
  - 40B Credit Amount: $1.25 (50% reduction) - $1.75 (100% reduction)
- BETO-DMA is collaborating with FAA to support this effort

DMA Progress – Recent Successes & Future Work

EPA Triennial Report to Congress

- BETO researchers at several national labs contributed significantly to the EPA Third Triennial Report to Congress on Biofuels and the Environment which
  - *"provides an update on the impacts to date of the RFS Program on the environment. This report assesses air, water, and soil quality; ecosystem health and biodiversity; and other effects. This third report also includes new analyses not previously included in the first and second reports."*
- The report closed for public comment on 3/6/23 and should be finalized this year. A draft is available on the EPA website.

*background courtesy of the NREL image library

DMA Progress – Recent Successes & Future Work

Increased Regional Studies and Access to Regional Data

- Current Administration and BETO priorities highlight a desire to understand the place-based benefits of different renewable energy technologies
- Several models and tools are being updated to work with local stakeholders/perform more refined regional analysis
  - SUPERBEEST at ANL work with the American Farmland Trust and Illinois farmers
  - NREL and PNNL collaboration on integrating DayCent data into GCAM to better predict local soil carbon impacts.
  - Plans to incorporate regional context for workforce development impacts into BEIOM at NREL
  - Plans to expand the use of tools like the BioC2G model at LBNL to allow for impact analysis at specific biorefinery sites

*background courtesy of the NREL image library

Thank you to our reviewers!

Questions?

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