U.S. DEPARTMENT OF ENERGY

Office of ENERGY EFFICIENCY & RENEWABLE ENERGY

Gen-1 Ethanol Opportunities: Improving Lifecycle GHG Benefits of Existing Biofuel Production

Marykate O'Brien
Systems Development & Integration Technology Manager

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DOE/EERE Guiding Principles

Our Mission

Accelerate the research, development, demonstration, and deployment (RDD&D) of innovative technologies that will transition Americans to a 100% clean energy economy no later than 2050 and ensure the clean energy economy benefits all Americans.

Investment strategies to achieve our Mission

EERE Program Priorities

- 100% Decarbonized electricity by 2035
- Rapidly decarbonize transportation across all modes
- Rapidly decarbonize energy intensive and high GHG industries
- Rapidly reduce the carbon footprint of buildings
- Provide the energy and water pathways to enable a net-zero agricultural sector

How we will insure the greatest impact

Ensure impacts benefit all Americans through key priorities:

- Environmental Justice and Equity
- Diversity in STEM
- Workforce Development
- State and Local Partnerships

Prioritize deployment for greatest impact: Deployment Activities

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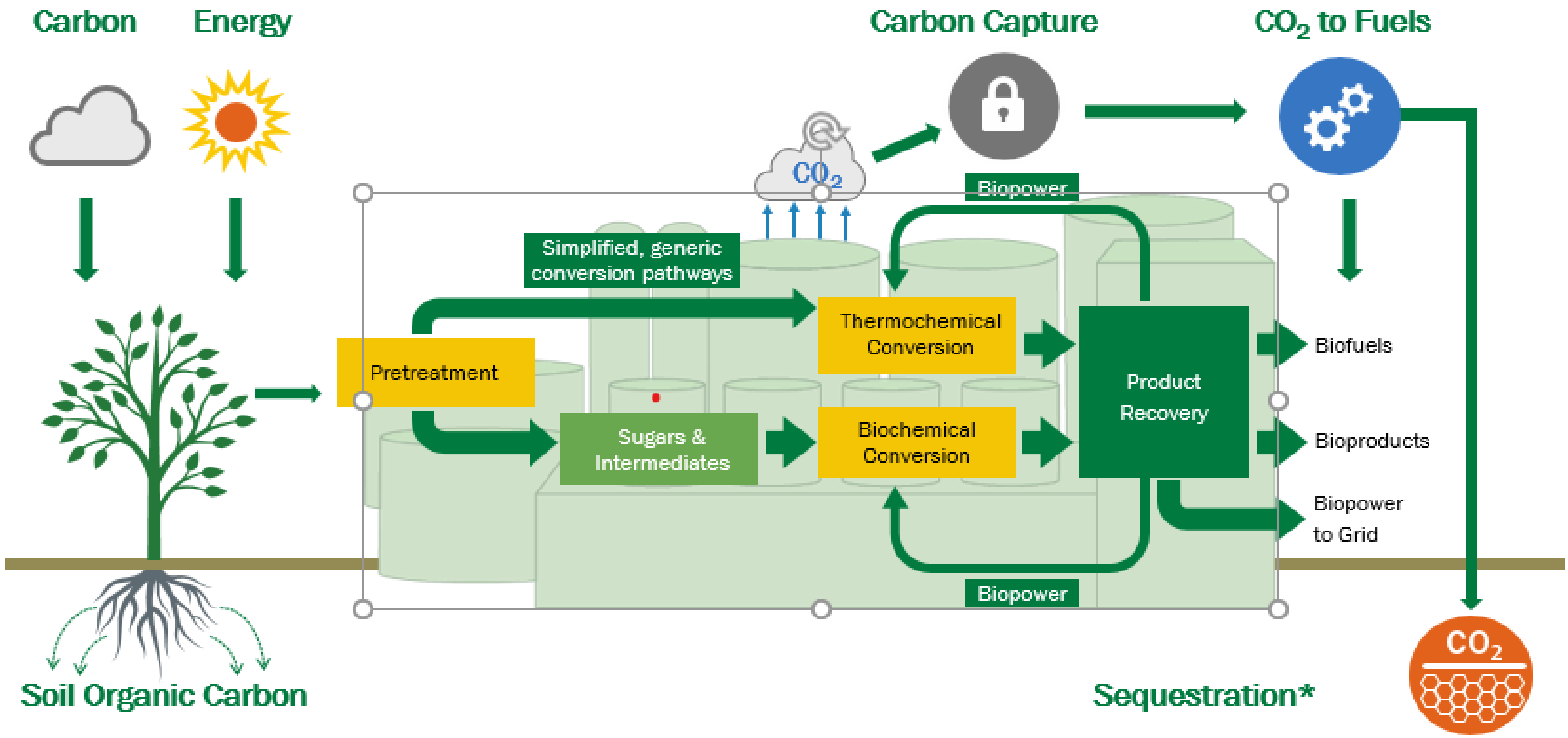
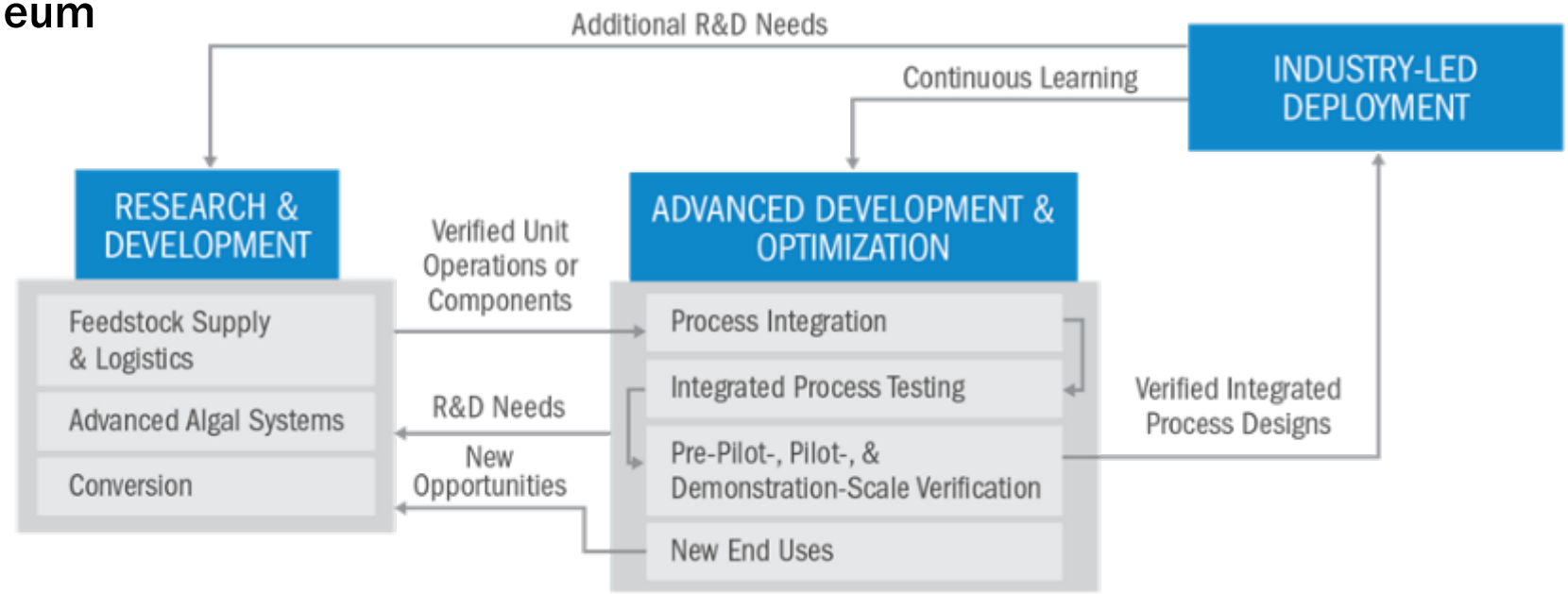
Pathways to Fuels, Bioenergy, and Bioproducts



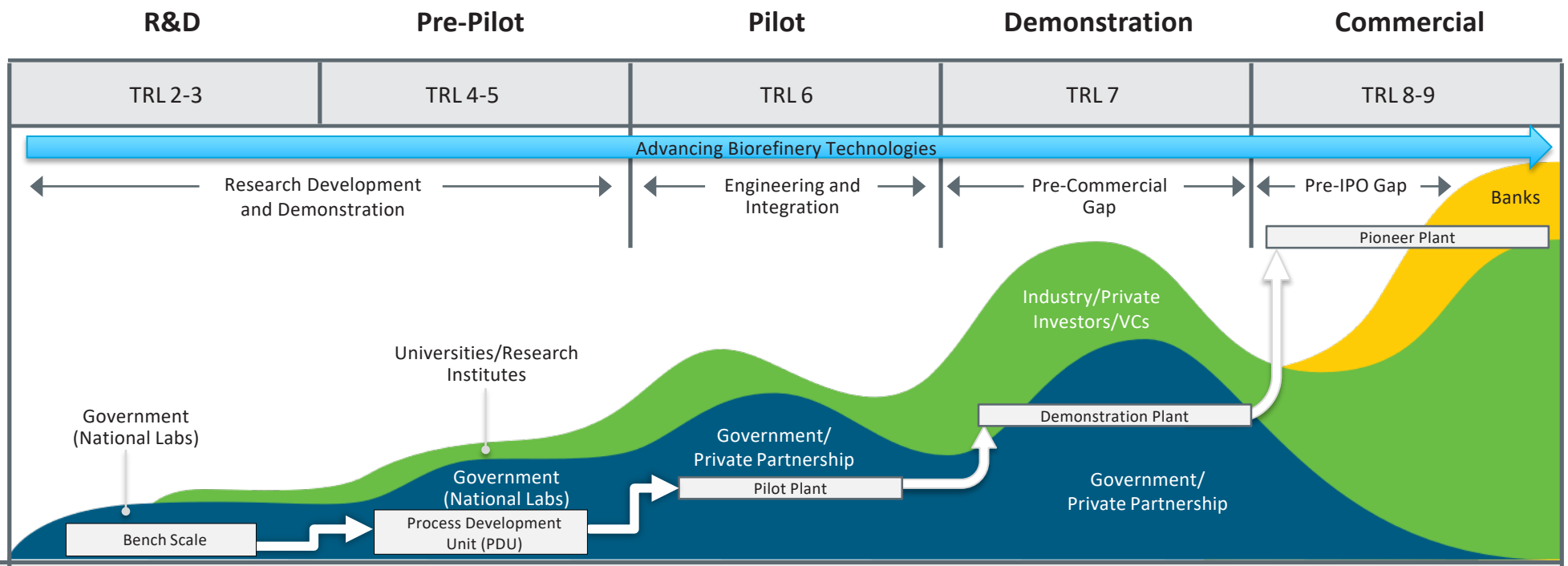
** Office of Fossil Energy R&D on technologies of relevance to bioenergy industry.*

BETO Demonstration Goals

- Systems Development and Integration Strategic Goal
  - To develop and test bioenergy production technologies through verified proof of performance in pre-pilot, pilot, and demonstration scale systems in relevant environments to enable and catalyze commercial deployment.
- Executes Final Step in BETO Goal:
  - By 2030, build and operate 4-5 Demonstration-scale integrated biorefineries with a focus on sustainable aviation fuels capable of >70% improvement in GHG emissions profile vs. Petroleum



BETO Strategy from R&D through Pioneer Refinery to Commercialization



	R&D	Pre-Pilot	Pilot	Demonstration	Commercial
Average Total Project Cost	$1–$5 Million	$5–$10 Million	$25–$50 Million	$100–$500 Million	$250–$500 Million
Average Biomass Throughput	Grams/Day	Kilograms/Day	<50 Tonnes/Day	50–250 Tonnes/Day	+250 Tonnes/Day
Production Volumes	mL/L (batch)	Liters/Gallons (batch)	0.1–1 M GPY (campaign)	1–10 M GPY (extended campaign continuous)	50 M GPY (continuous)

Government Project Recipients and Partners Banks/Bonds/Institutional Investors

Elements of Scale-up Approach

- **Funding opportunities for pre-pilot, pilot, and demonstration scale projects**
  - **Annual opportunity for new applications starting in FY 2021**
- **Allow a variety of feedstocks**
  - Traditional cellulosic feedstocks
  - MSW, CO_2, CO, flue gas, and biogas
  - Corn starch and oilseeds
- **Allow bioproduct opportunities to enable biofuels development**
- **Leveraging existing industrial infrastructure supply chains, and resources**
  - **1st Generation ethanol**, pulp and paper, petroleum refineries
- **Encourage predictive models and high-performance computing to lower risk and accelerate scale-up**

Workshop Introduction

Here is what we at BETO know:

- The existing U.S. ethanol industry has sufficient existing capacity to produce 17.6 Billion gallons and reduce GHG emissions by approximately 50 million metric tons per year versus petroleum, approximately 2% of total U.S. transportation emissions.
- As recently as 2019, the 214 U.S. ethanol plants supported 68,600 jobs —many in rural areas.
- Existing technologies and agricultural practices have the potential to make significant improvements in the reduction of lifecycle greenhouse gas emissions (GHG) of fuel ethanol from approximately 40% - 71.6% as compared to petroleum baseline

Here is what we need to know from all of you:

- What technology is the industry already utilizing to keep GHG emissions low
- Of this existing technology, where is there room for improvement
- Where are the gaps? What are areas for which technology still needs to be developed from the ground up
- Includes all aspect of the corn to ethanol chain. Modeling and Feasibility Studies, Farming, Harvesting, Transportation, Feed Prep, Conversion, Upgrading, Waste, etc.
- Where and how can the government best serve the industry

Workshop High Level Agenda

- 9am MT (11am ET) Morning Plenary
- 10am MT (12pm ET) Morning Breakout Session: Technology Focused
- 12:15pm MT (2:15pm ET) Lunch Break
- 12:45pm MT (2:45pm ET) Afternoon Plenary
- 1:00pm MT (3:00pm ET) Afternoon Breakout Session: Data and Analysis Focused
- 1:55pm MT (3:55pm ET) Closing Remarks
- 2:00pm MT (4:00pm ET) Adjourn

Speaker Introductions

Scott Richman

Chief Economist,

Renewable Fuels Association (RFA)

Speaker Introductions

Michael Wang

Director

Systems Assessment Center,

Argonne National Laboratory

Speaker Introductions

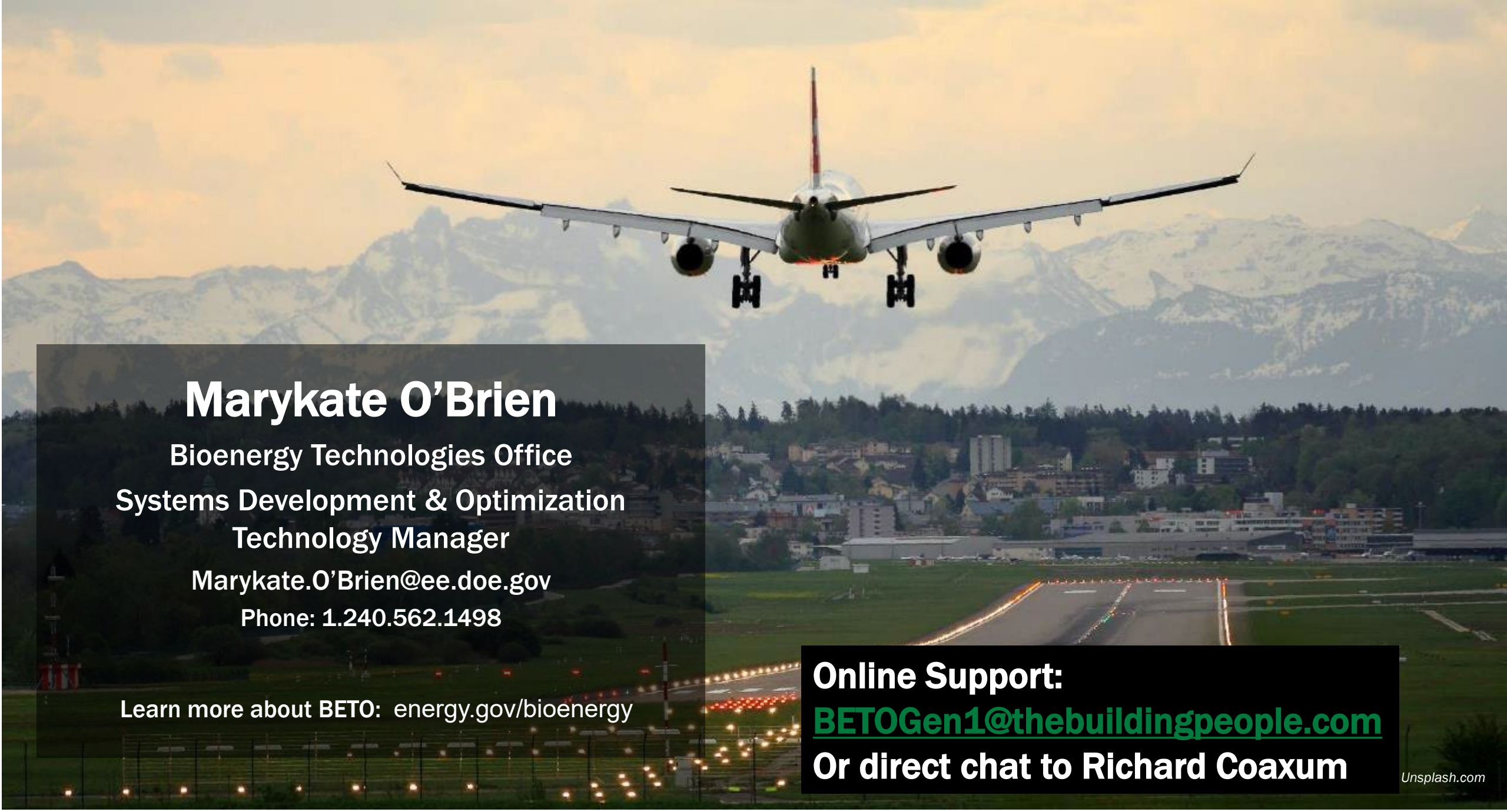
Zia Haq

Senior Analyst,

Bioenergy Technologies Office (BETO)

Questions

- Please type your question in the Chat box and we will try and get to as many as we can with the time remaining.
- After the presentation, we will take any additional questions if we have time.
- Keep yourself muted, and camera off unless you are asking a question.



Marykate O'Brien

Bioenergy Technologies Office

Systems Development & Optimization Technology Manager

Marykate.O'Brien@ee.doe.gov

Phone: 1.240.562.1498

Learn more about BETO: energy.gov/bioenergy

Online Support:
BETOGen1@thebuildingpeople.com
Or direct chat to Richard Coaxum

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