

# Sustainable Aviation Fuel Research and Development at DOE

DOE Bioenergy Technologies Office  
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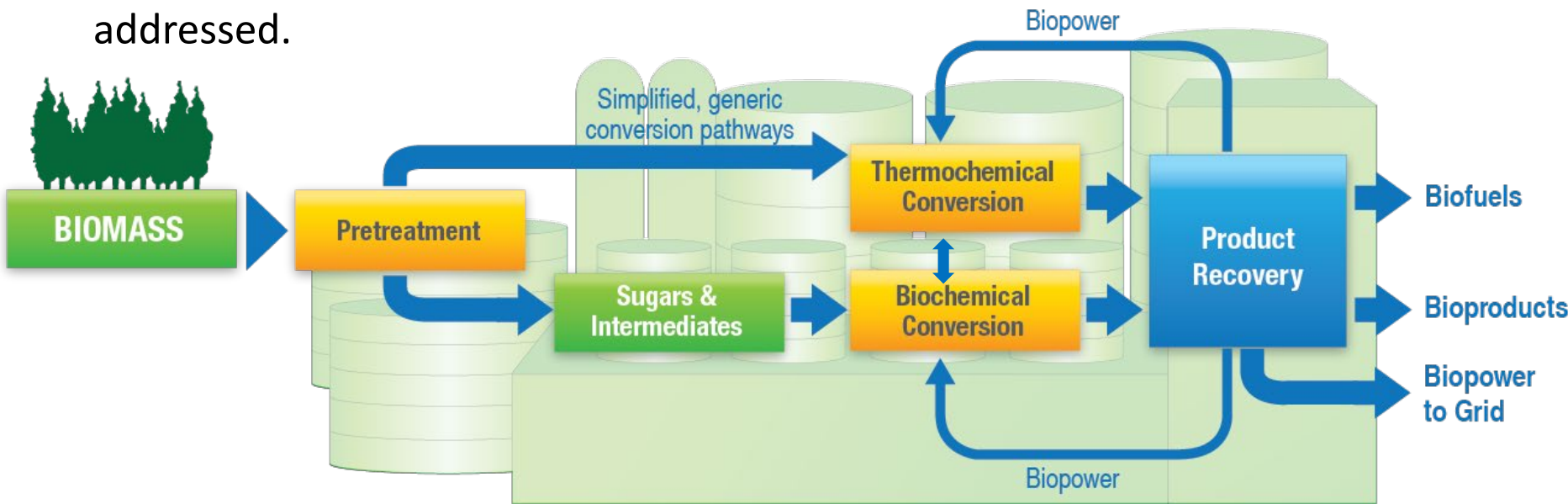
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# BETO's Perspective on Renewable Fuels

- Opportunity for **significant new markets for biomass**
- Biomass can fully **supply future aviation/ maritime/rail** (requires 75% of all feedstocks)
- Biggest market pull is **in sustainable aviation fuels (SAF)**
- DOE **has three large-scale SAF demo projects (Fulcrum, Red Rocks, LanzaTech)**
- Provides market for **current ethanol** (~17B gal, ~40% of corn production)
- Supports decarbonization of chemicals via **bioproducts**, and decarbonization of agriculture through healthy forests and sustainable agriculture
- **CO<sub>2</sub>-to-fuels** remains to be explored

# Biofuels Conversion Technologies

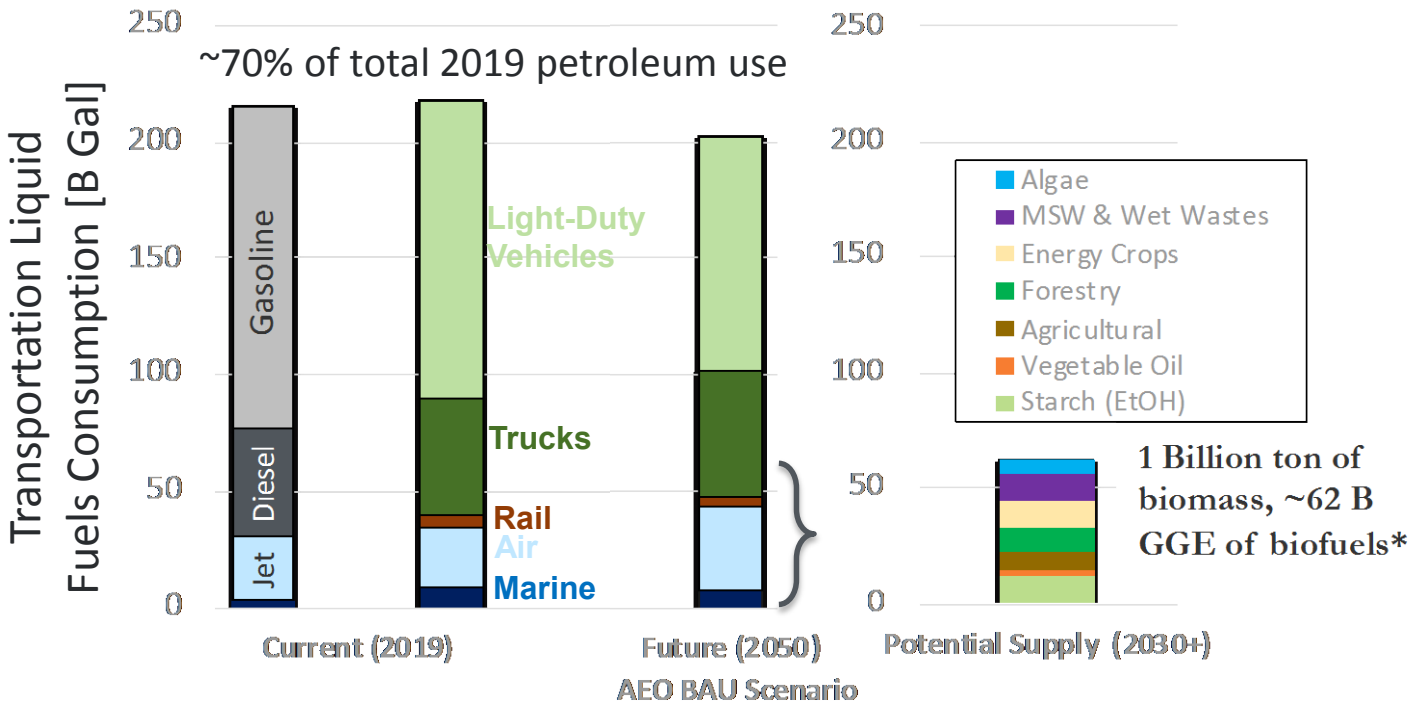
- DOE is focusing on advancing renewable gasoline, diesel, and jet fuels technologies, in addition to bioproducts and biopower.
- Technical, construction, operational and financial/market risks need to be addressed.



## Key Challenges

Biomass	Pretreatment	Conversion	Product
<ul style="list-style-type: none"> <li>• Reliable supply</li> <li>• Consistent quality</li> <li>• Affordable delivery</li> </ul>	<ul style="list-style-type: none"> <li>• Biomass feeding, sizing and moisture</li> <li>• Solids handling</li> <li>• Material of construction</li> </ul>	<ul style="list-style-type: none"> <li>• Products Yields</li> <li>• Material of construction</li> <li>• Catalysts</li> <li>• Fermentation organisms</li> </ul>	<ul style="list-style-type: none"> <li>• Separations</li> <li>• Catalytic upgrading</li> <li>• Recycle loops</li> </ul>

# Growing Markets for Biomass



\* Gal = gallons | MSW = municipal solid waste | GGE = gasoline gallon equivalent | AEO BAU = Annual energy outlook, business as usual

# USDA-FAA-DOE MOU

- Establishes Sustainable Aviation Fuel Grand Challenge to reduce cost, enhance sustainability, and expand production of SAF that achieves a minimum of a 50% reduction in lifecycle greenhouse gas (GHG) and meet goal of sufficient SAF to meet 100% of aviation fuel demand by 2050.
- Accelerate research, development, demonstration, and deployment for innovative solutions and technologies and policy framework to enable an ambitious government wide commitment to scale up production of SAF to 35 billion gallons/year by 2050. A near-term goal of 3 billion gallons/year is established as a milestone for 2030.
- Empower SAF Inter-agency Working Group under Biomass Research and Development Board to develop a Grand Challenge roadmap within six months. Purpose of roadmap is to provide details of specific activities that should be undertaken by Parties to achieve 2050 goals and interim milestones of Grand Challenge.

MOU is available at: And [S1-Signed-SAF-MOU-9-08-21\\_0.pdf \(energy.gov\)](#)

# FY21 Scale-up and Conversion FOA Selected Projects

- Support high-impact RD&D to enable growth and innovation to accelerate low-carbon biofuels and associated co-products.
- Focus on developing and demonstrating low-carbon biofuels for aviation, marine and heavy-duty markets at \$2.50/GGE by 2030. Must deliver at least 70% GHG reduction.
- Scales / Subtopics
  - Pre-pilot Technologies
  - Pilot scale (20,000 gal/year)
  - Demonstration scale (1,000,000 gal/year)
- <https://eere-exchange.energy.gov/Default.aspx#FoalId5295fbd3-50f4-4dfb-8c70-3f6911c5da10>



# BETO SAF Pre-Pilot Scale Projects

Company	Project Title	Feedstock
Alder Energy	Field-to-Fuel Production of Carbon-Negative Sustainable Aviation Fuel from Regenerative Agriculture Biomass	Miscanthus
Gas Technology Institute	Novel Electric Reformer for Drop-In Fuels from Waste CO <sub>2</sub> or Biogas	Waste CO <sub>2</sub> from ETOH plants or bio-gas from digestors
Gas Technology Institute	R-GAS Advanced Gasification Pre-Pilot Demonstration for Biofuels (BioRGAS)	Biomass and sorted municipal solid waste
Global Algae Innovations	Direct Air Capture Algae Cultivation	Micro-algae
Lanzatech	Low-Cost Sustainable Aviation Fuel from Waste CO <sub>2</sub>	Biogenic waste CO <sub>2</sub> and H <sub>2</sub>
Micro-Bio Engineering	Clean Water, Sustainable Aviation Fuel and Renewable Diesel Production from Wastewater	Waste-water sludge
Texas A&M AgriLife Research/Texas A&M University	Scale-Up of Biodegradable Plastic Product to Enable Production of Economic Renewable Aviation Fuels	Lignin
University of Maryland: College Park	Near-Critical Fluids Treatment for Liquefaction and Extraction of Biofuels	Biomass, algae, municipal solid waste

# BETO SAF Pilot and Demonstration Scale Projects

Company	Project Title	Feedstock
D3Max LLC	Production of Sustainable Aviation Fuels from Corn Stover via NREL's Deacetylation and Mechanical Refining Technology (SAFFiRE)	Corn stover
SkyNRG Americas Inc.	Project LOTUS: Landfill Off-gas to Ultra-Low Carbon Intensity SAF	Landfill gas
T2C-Energy	Demonstration Scale-Up: TRIFTS Biogas to Renewable Fuel	Landfill gas
Avapco	Sugar is the New Crude	Construction waste, energy cane, forest residues