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ALLIANCE AMERICA

# UNDERSTANDING THE CHANGING FUELS LANDSCAPE

Gulf Coast Conference  
October 10-11, 2023

# CLEAN FUELS APPRECIATES THE SUPPORT OF OUR FARMERS AND THEIR CHECKOFFS



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# CLEAN FUELS ALLIANCE AMERICA VISION

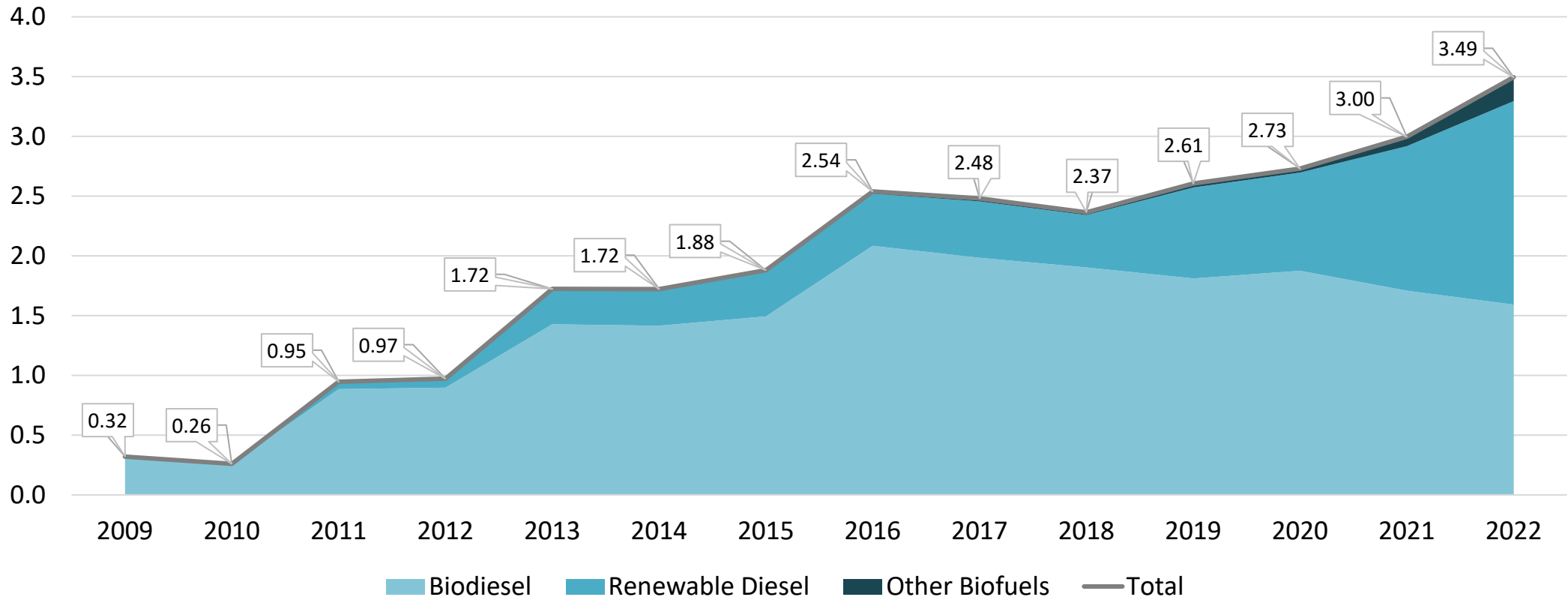
- ***Biodiesel, renewable diesel and sustainable aviation fuel*** will be recognized as mainstream low-carbon fuel options with superior performance and emission characteristics. In on-road, off-road, air transportation, electricity generation, and home heating applications, use ***will exceed 6 billion gallons by 2030***, avoiding over 50 million metric tons of CO<sub>2</sub> equivalent greenhouse gas emissions annually. With advancements in feedstock, use will reach 15 billion gallons by 2050.



# U.S. BIOMASS-BASED DIESEL CONSUMPTION

## U.S. BBD Consumption

Billion Gallons



# GLOBAL PROGRAMS AND DEMAND

- North America
  - United States - Federal program (RFS, RINs), State policies (mandates, tax incentives, LCFS)
  - Canada - Clean Fuel Standard (both provincial and Federal)
- South America
  - Brazil – RenovaBio (B12 – B15)
  - Argentina – variable export taxes / tariffs
- Europe - Renewable Energy Directive (RED II), capping biofuels produced from virgin vegetable oils
- Far East
  - Indonesia – B35/B40 regulations
  - Singapore – B25-B50
  - India – B5



# WHY ?

Advanced Biofuel; min. 50% GHG Reduction

Can Be Used in Any Diesel-Fueled Application **Federal Policy**

**Low Carbon** Lower PM Health Benefits **ESG**

Can Be Used In Any Compression Ignition Engine

**Sustainable** Improved Combustion Reduces Emissions

**Domestic Jobs** Bridge to Electrification State Policy

Proven Performance **Energy Security** Climate Change



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# WHAT DOES IT TAKE ?

**Federal Policies** Proven Performance

OEM Support Appropriate Test Methods

Regulations **Cost Effectiveness**

**Durability** Fuel Specifications **Infrastructure**

Consumer Confidence State Policies

**Compatibility**





# MARKET FORECASTS

- EIA revising higher estimates for demand AND supply of both biodiesel and renewable diesel throughout 2023 and 2024
- Industry expects SAF production to account for 30% of overall renewable fuel production by 2030
  - 85% of SAF expected to result from using fats, oils and greases (HEFA)
- Credits along with federal / state regulatory programs will impact volumes and direction; assuming no significant changes in feedstock choices and availability



# DIESEL FUEL INDUSTRY CHANGES

- Carbon reduction is now driving the market
- B20 is simply not enough for many policy/ESG goals
- On- and Off-Road applications will prefer renewable diesel and R80/B20 blends in LCFS markets
- Electrify everything possible; low carbon fuels for the rest (SAF)

## Industry Signals:

- B20 ➡ B50 ➡ B100 in Home Heating Oil
- Ocean-Going Marine Fuels Want B50 ➡ B100
- Railroads Wanting At Least B20
- Interest in Low Carbon Power/Electricity Generation
- B20/B30 in On/Off road Engines, Some B50/B100



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# WHAT'S YOUR PERSPECTIVE ?



The same figure (issue) often leads to different interpretations and implications based upon your perspective and desired outcome



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# CLEAN FUELS TECHNICAL OBJECTIVES

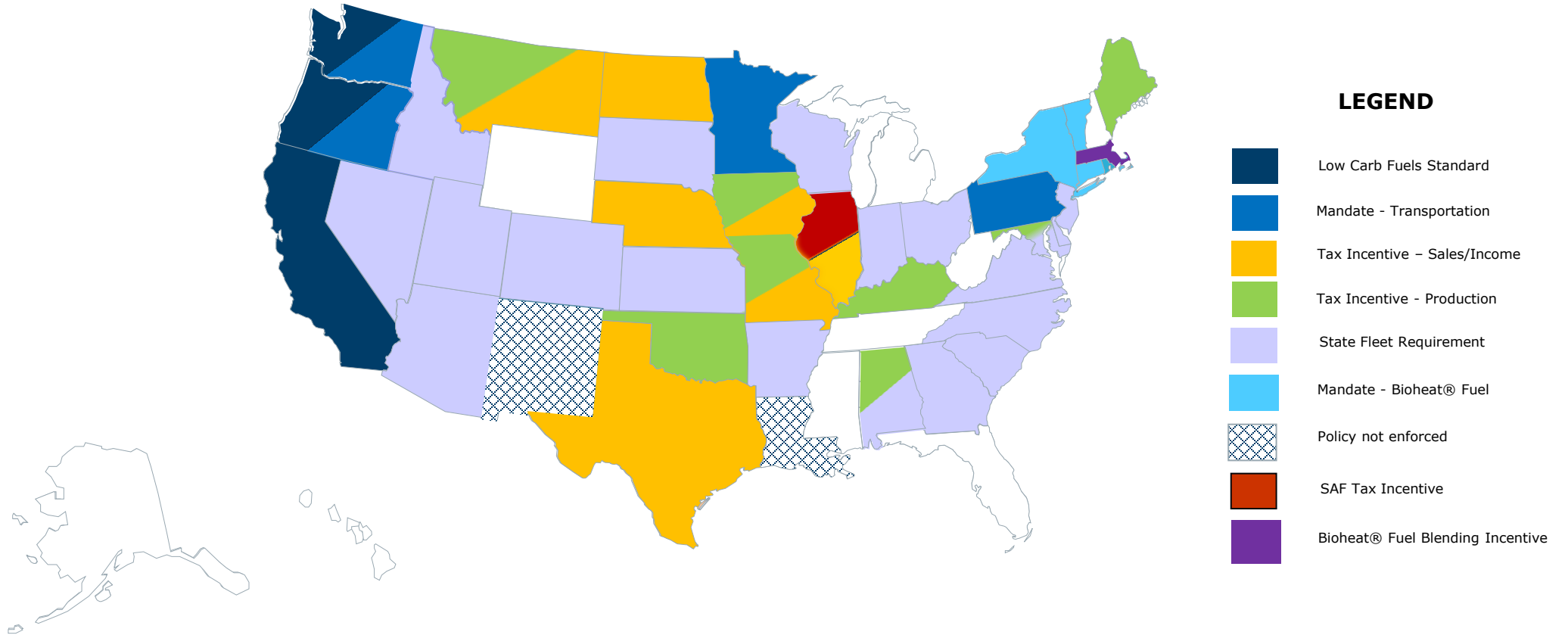
- Prioritize work needed for biodiesel to have a place in 2030, 2050
- Focus on markets that make the most sense for higher volumes and higher blends
- Higher baseline level of OEM support
- Specific applications for B50/B100, R80/B20 and R50/B50
- Work cooperatively with OEMs (and others) that are interested
  - Optimus, Pepsi, Municipalities
  - Create OEM market differentiation/advantage for high blend support
- Some efforts will likely be proprietary to an individual OEM, or market application
- Upcoming RD & SAF projects

# FEDERAL POLICY BASELINES

- Federal legislation –
  - Clean Air Act
  - Energy Policy Act
  - Renewable Fuel Standard – annual renewable volume obligations
  - Inflation Reduction Act
- Renewable Identification Numbers (RINs)
- Blenders' Tax Credit
  - Transitioning to Clean Producers Credit
- NO consistent long term policies

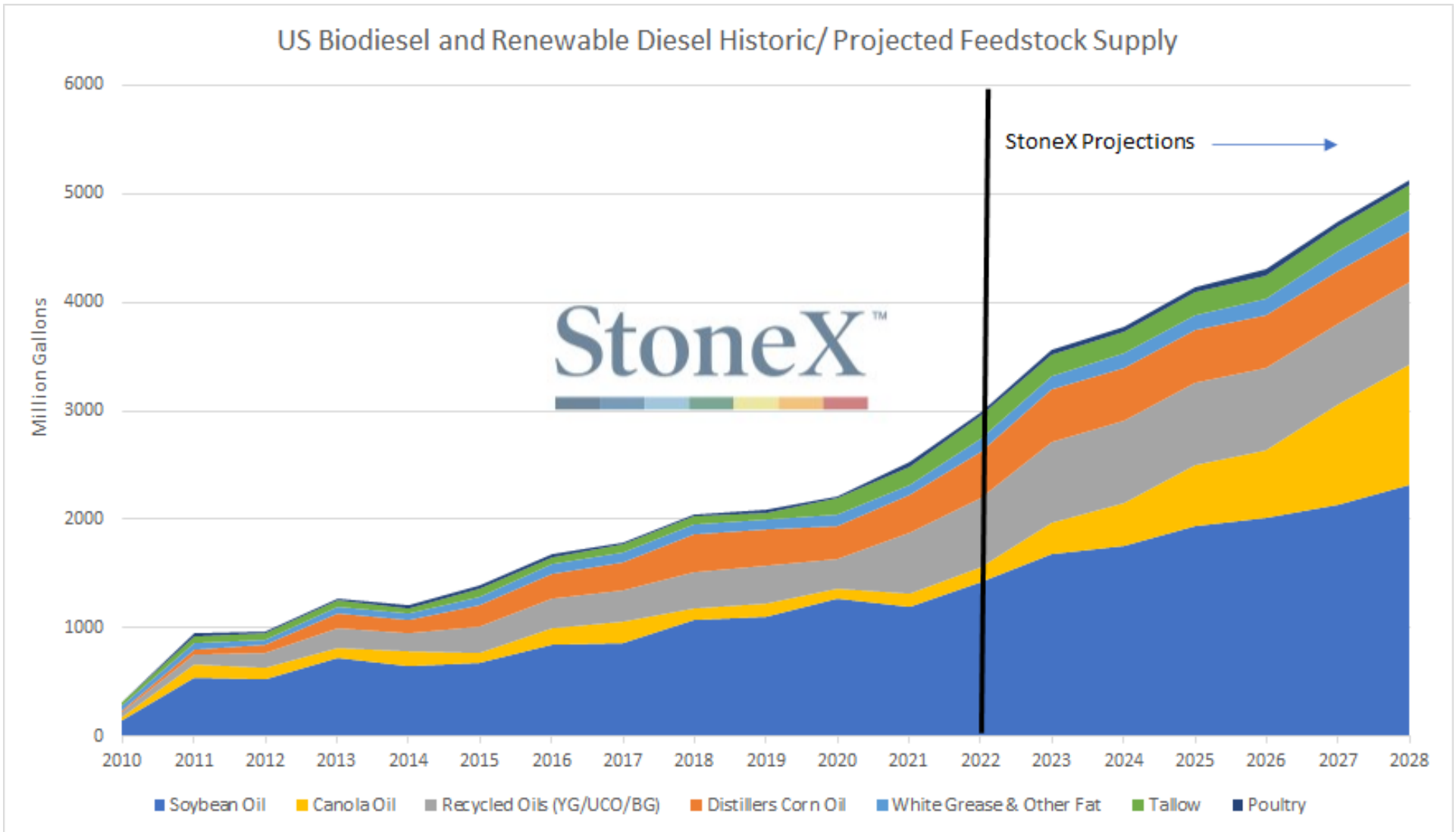


# STATES WITH NOTABLE BIODIESEL POLICIES



Current as of 06/06/2023  
Data from DOE Alternative Fuels Data Center and Individual State Statutes

# FEEDSTOCK USAGE



Sources: WASDE, National Renderers Association



# FEEDSTOCK OPTIONS FOR BIOMASS-BASED DIESEL

## EPA APPROVED PATHWAYS



Distillers Corn Oil



Soybean Oil



Camelina



Canola Oil (biodiesel only)\*

\* Pathway now approved for Renewable Diesel



Used Cooking Oil/Yellow Grease



Animal Fats



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# CRUSH EXPANSION AND MEAL IMPLICATIONS



# WINTER ANNUAL OILSEEDS: CROPS WITH ECO-SYSTEM SERVICE BENEFITS OF A COVER CROP *(EXAMPLES)*



Brassica carinata



CoverCress™



Winter Canola



Camelina



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# PRODUCTION TECHNOLOGIES / ECONOMICS

## Biodiesel Reaction

Reacting:      In the Presence of a Catalyst

100 Lbs.  
Vegetable Oil  
or  
Animal Fat

+  
10 Lbs.  
Alcohol

Methanol  
or Ethanol

**Sodium Hydroxide or  
Potassium Hydroxide**



Yields:

**100 Lbs.  
Biodiesel  
+  
10 Lbs.  
Glycerine**

Transesterification process produces mono-alkyl esters – chemically similar to diesel fuel

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# DIFFERENT FUELS – BD, RD, SAF

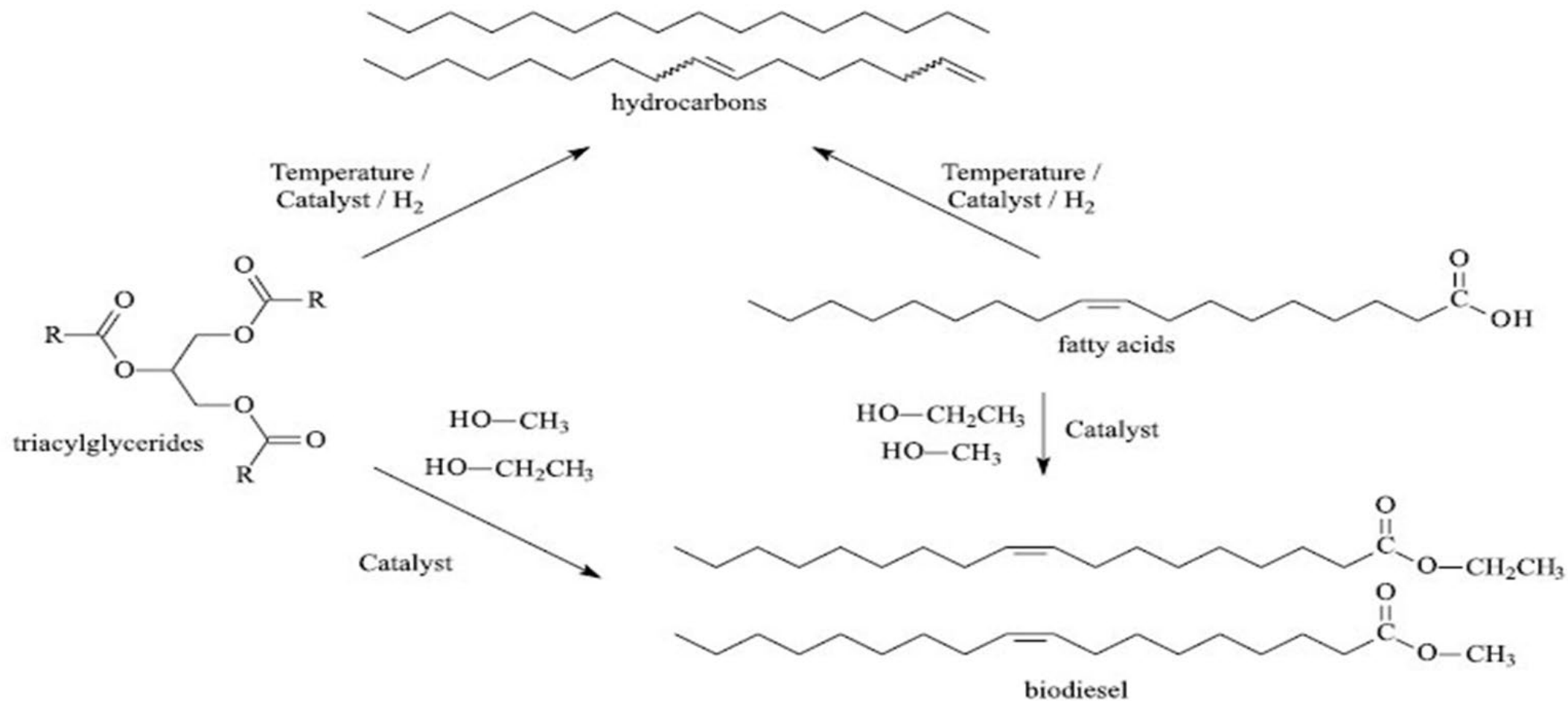
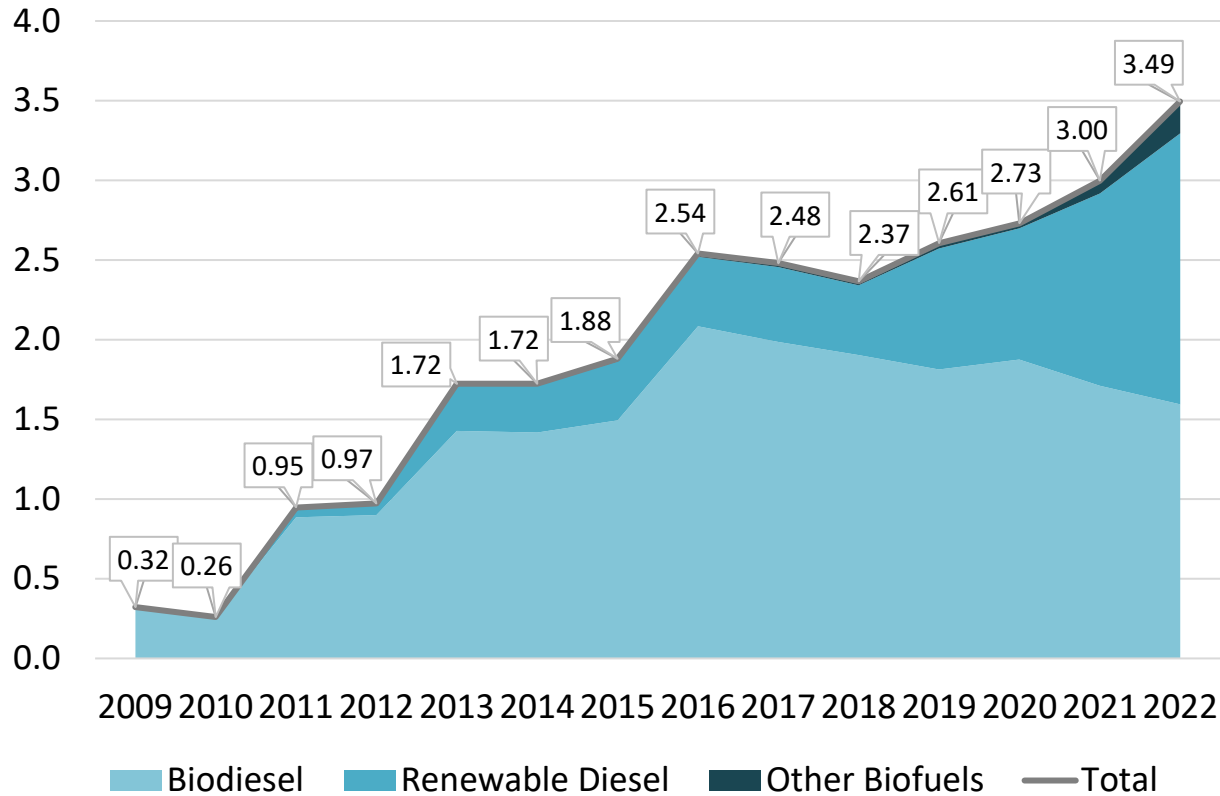


Figure 2. Biofuels (hydrocarbons and biodiesel) obtained from triacylglycerides and fatty acids. Adapted from reference 13.

# BBD SUPPLY PROJECTED TO GROW

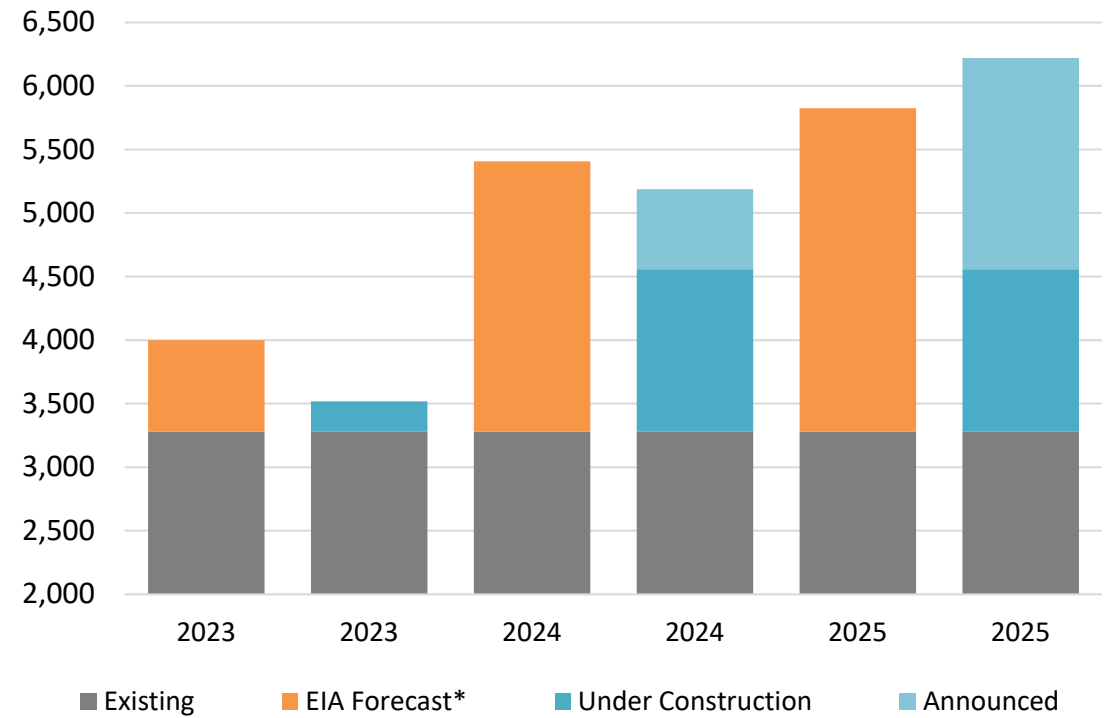
## U.S. BBD Consumption

Billion Gallons



## Renewable Diesel Capacity Growth

MMGY



\*EIA forecasts "Renewable diesel and other biofuels" plant capacities; this includes SAF and renewable naphtha

Sources: EIA, Company announcements, Trade press





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# FUEL PERFORMANCE



# SPECIFICATION HISTORIES

Some renewable fuels are arguably the most scrutinized fuels in the marketplace.

ASTM D6751 (Biodiesel) was first published in 2002. Since then, it has had 29 revisions (in 21 years) and 23 individual requirements.

ASTM D975 (Diesel) was first published in 1978 and had its first revision in 1991. It has had more recent editions to account for new renewable fuels, but still only has 16 individual requirements.





# GRAND SAF CHALLENGE

The result of a program between DoE, DoT and USDA to develop a comprehensive strategy to produce sustainable aviation fuel - displacing petroleum aviation fuels that currently account for 2% of global Greenhouse Gas Emissions

The goal is to produce/consume 3 billion gallons of SAF by 2030; while working towards meeting 100% of aviation fuel demand by 2050

Currently, the U.S. consumes over 18 billion gallons of aviation fuel annually

# ADDITIONAL MARKETS RELYING ON USING HIGHER BLENDS & B100

- Marine Fuel (“blue” v “brown” water) applications
  - Extreme pressure to reduce carbon
  - ISO 8217 balloting up to B100 (meting either ASTM D6751 or EN 14214) in all distillate and residual fuel grades as a change to the conventional marine fuel standard
  - Higher blends being used globally today without incident
    - B25 – Singapore
    - B50 – Europe
    - B100 – Ship/Engine mfg trials
  - Recent analytical data shows biodiesel improves properties of residual fuel oils
  - Expect to publish next revision in Q1 of 2024
  - Working to address restrictions in RFS against use in ocean-going vessels

# ADDITIONAL MARKETS RELYING ON USING HIGHER BLENDS & B100

- Railroads
  - Extreme pressure to reduce carbon
  - Class I railroads (largest) are putting pressure on locomotive manufacturers to approve B20.
    - Progress Rail (Cat/EMD) approved B20 last year
    - Wabtec (GE) quickly working on public B20 approval
  - Several Class I railroads already using B20 in several geographic regions where available
  - Clean Fuels recently signed NDA to work with Class I railroad on B20+ blend performance
  - Regional railroad fuel suppliers discussing interest in building biodiesel plants

# WHY ITS ALL POSSIBLE



## Assessment of BQ-9000 Biodiesel Properties for 2022

Robert L. McCormick

*National Renewable Energy Laboratory*

*Produced under direction of Clean Fuels Alliance America by the National Renewable Energy Laboratory (NREL) under Cooperative Research and Development Agreement CRC-15-593.*

This is the sixth in a series of reports documenting the quality of biodiesel from U.S. and Canadian-based producers that participate in the BQ-9000 program, the biodiesel industry voluntary quality assurance program. Participants agreed to provide monthly data on critical quality parameters for calendar year 2022. The quality data was provided to a team of experts, who removed any identifying company information and provided anonymized data to the National Renewable Energy Laboratory (NREL) for statistical analysis.



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# BIODIESEL QUALITY TECHNICAL REPORTS

- Available free from NREL's website

2017 <https://www.nrel.gov/docs/fy20osti/75795.pdf>

2018 <https://www.nrel.gov/docs/fy20osti/75796.pdf>

2019 <https://www.nrel.gov/docs/fy20osti/76840.pdf>

2020 <https://www.nrel.gov/docs/fy21osti/79815.pdf>

2021 <https://www.nrel.gov/docs/fy22osti/83108.pdf>

2022 \* <https://www.nrel.gov/docs/fy23osti/86227.pdf>

\* Just published 6/8/2023

# WHAT DOES IT TAKE TO SURVIVE / THRIVE ?

Charles Darwin purported that, "It is not the strongest of the species that survive, nor the most intelligent, but rather the one most adaptable to change."



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For more in-depth information,  
register for the Clean Fuels Conference.



[CleanFuelsConference.org](https://CleanFuelsConference.org)

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