

# Decarbonization Strategies: Bioenergy

Valerie Reed, Ph.D.  
Director, Bioenergy Technologies Office  
Department of Energy



# Biden Administration Priorities: Target Set



*Building on Past U.S. Leadership, including Efforts by States, Cities, Tribes, and Territories, the New Target Aims at 50-52 Percent Reduction in U.S. Greenhouse Gas Pollution from 2005 Levels in 2030*

White House, April, 2021

## **Goal:**

Net Zero emissions economy wide by 2050

## **Benefits:**

Support of American workers in good paying jobs  
Improve the health of all of our communities  
Improve the competitiveness of our economy

## **Process:**

Government Wide Approach  
Diverse Stakeholder Engagement  
Important sectors - electricity, transportation, buildings, industry, and lands

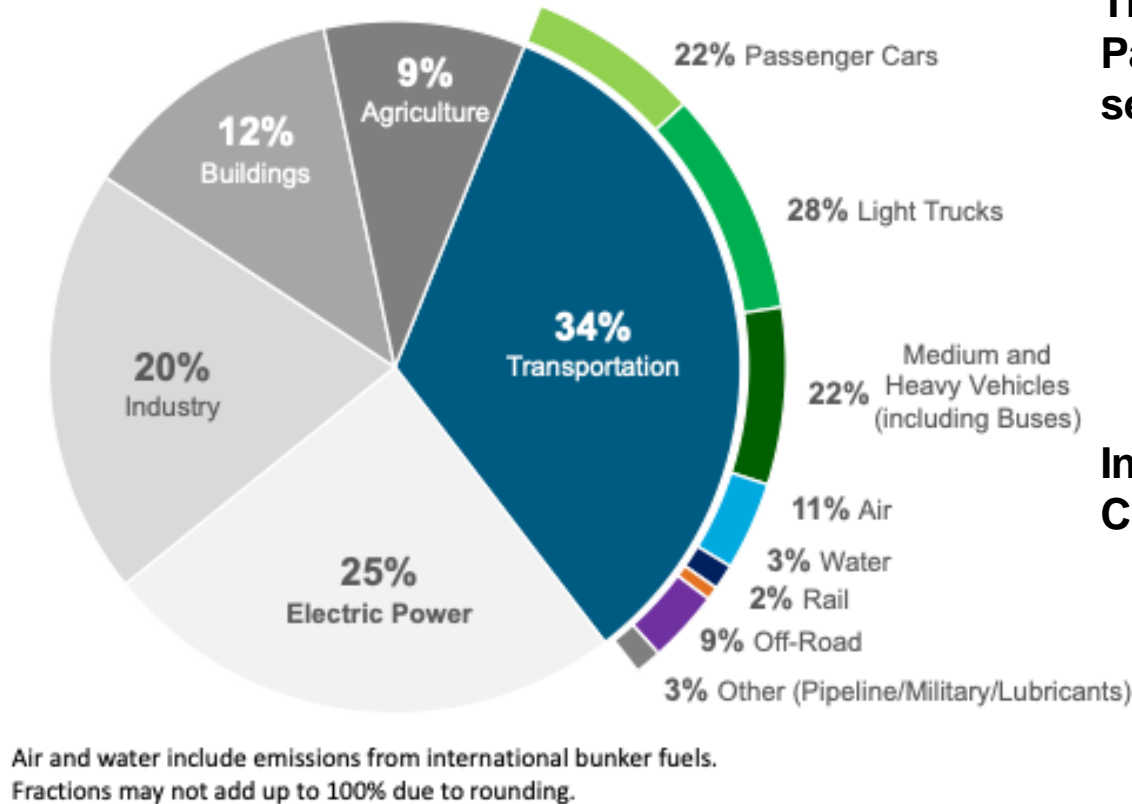


# DOE/EERE Guiding Principles

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	<div>EERE Program Priorities</div> <ul style="list-style-type: none"><li>• 100% Decarbonized electricity by 2035</li><li>• Rapidly decarbonize transportation across all modes</li><li>• Rapidly decarbonize energy intensive and high GHG industries</li><li>• Rapidly reduce the carbon footprint of buildings</li><li>• Provide the energy and water pathways to enable a net-zero agricultural sector (</li></ul>
How we will insure the greatest impact	<div>Ensure impacts benefit all Americans through key priorities:</div> <div><ul style="list-style-type: none"><li>• Environmental Justice and Equity</li><li>• Diversity in STEM</li><li>• Workforce Development</li><li>• State and Local Partnerships</li></ul></div> <div>Prioritize deployment for greatest impact: Deployment Activities</div>

# Bioenergy : Decarbonization in Multiple Sectors of the Economy

## 2019 U.S. GHG Emissions



### Transportation Sector:

**Passenger Cars, Air, Marine, Rail 12.6% GHG emissions (37% of sector)**

- Dramatic reduction in CO<sub>2</sub> from biobased ethanol by 2030 to meet legacy fleet needs.
- Increase demonstration of Sustainable Aviation Fuels
  - 3B gal by 2030
  - 35 B gal by 2050 (100% of projected need)

### Industry Sector:

**Chemicals 5.5% GHG emissions (19% of industrial sector)**

- Increased production of biobased direct displacement chemicals by 2030
- Performance enhanced biobased chemicals by 2040
- Displace 100MMtons/288 MM tons Chemicals by 2050
- Main focus polymers

### Agricultural Sector: 9% GHG Emissions

- Healthy Forests
- Sustainable Agriculture
- Manure Management

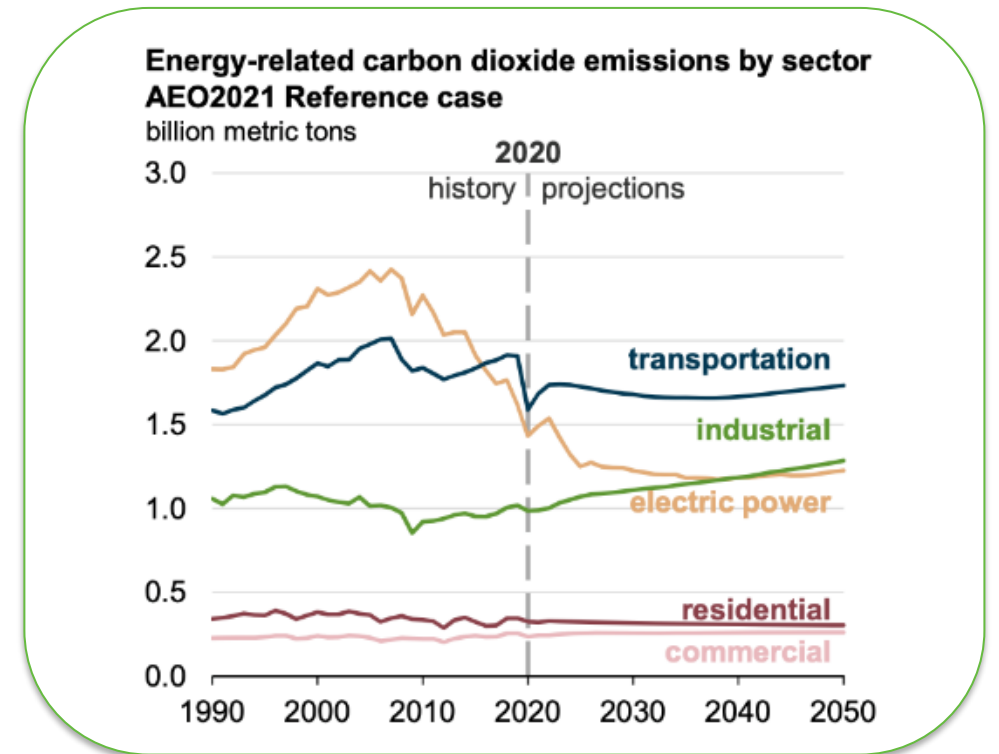
1 Billion Tons of Biomass = 450-500 MMTons CO<sub>2</sub> reduced annually across multiple sectors



# Context for Transportation Decarbonization

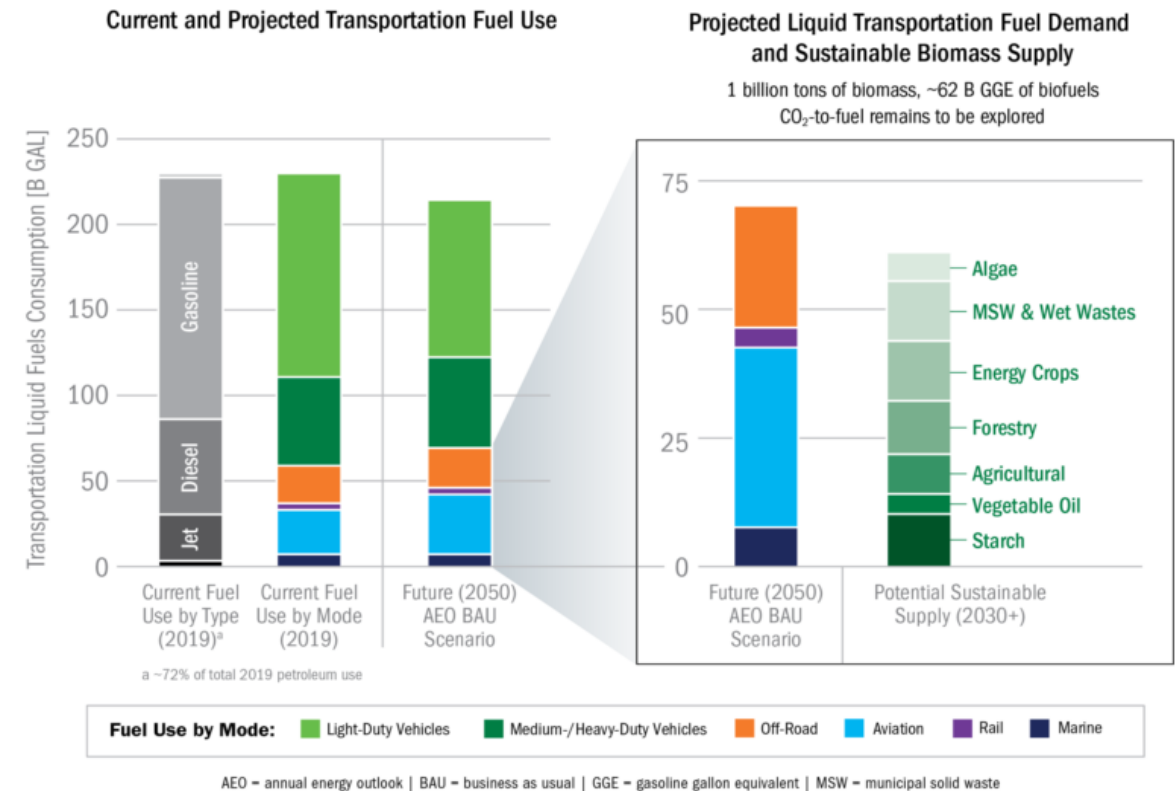
## Rapidly decarbonize transportation across all modes

- **Largest source of CO<sub>2</sub> emissions:** net-zero by 2050 requires dramatic improvement from transportation
- 50% of **energy expenditures** and a **local pollution issue**
- The magnitude of industrial change and direct consumer touch points with transportation require **market-pull solutions**
- Must **support demand for growth in mobility options**
- Achieving 2050 goal requires success in the market by 2035 which **requires immediate direction**
- Significant implications for global competitiveness, trade, and **domestic jobs**



# Transportation Decarbonization: Sustainable Aviation Fuels

Feedstock	Ex Conversion Processes	Feedstock Input million dry tons/yr
Seed Oils	FAME	9
Corn grain	Fermentation to EtOH	148
Fats, oils, greases	HEFA	7
Forestry resources & woody wastes	Gasification with Fischer Tropsch synthesis	133
Woody energy crops		50
MSW		55
Agricultural residues	Isobutanol - Alcohol to Jet	149
Herbaceous energy crops		190
Algae	Combined Algae Processing	24
Algae	Hydrothermal Liquefaction	24
Wet Wastes		78
Currently used biomass - non-biofuel		238
<b>TOTALS</b>		<b>1,103</b>



**Develop and demonstrate technologies to cost-effectively decarbonize aviation and marine industry**

- Continue R&D to reduce cost of multiple feedstock conversion paths with >70% CO<sub>2</sub> emission reduction.
- Demonstrate technologies to improve lifecycle GHG emissions of 17B gal/year corn-ethanol industry to >70% reduction
- Build and operate 4-5 Demonstration-scale drop-in integrated biorefineries by 2030.

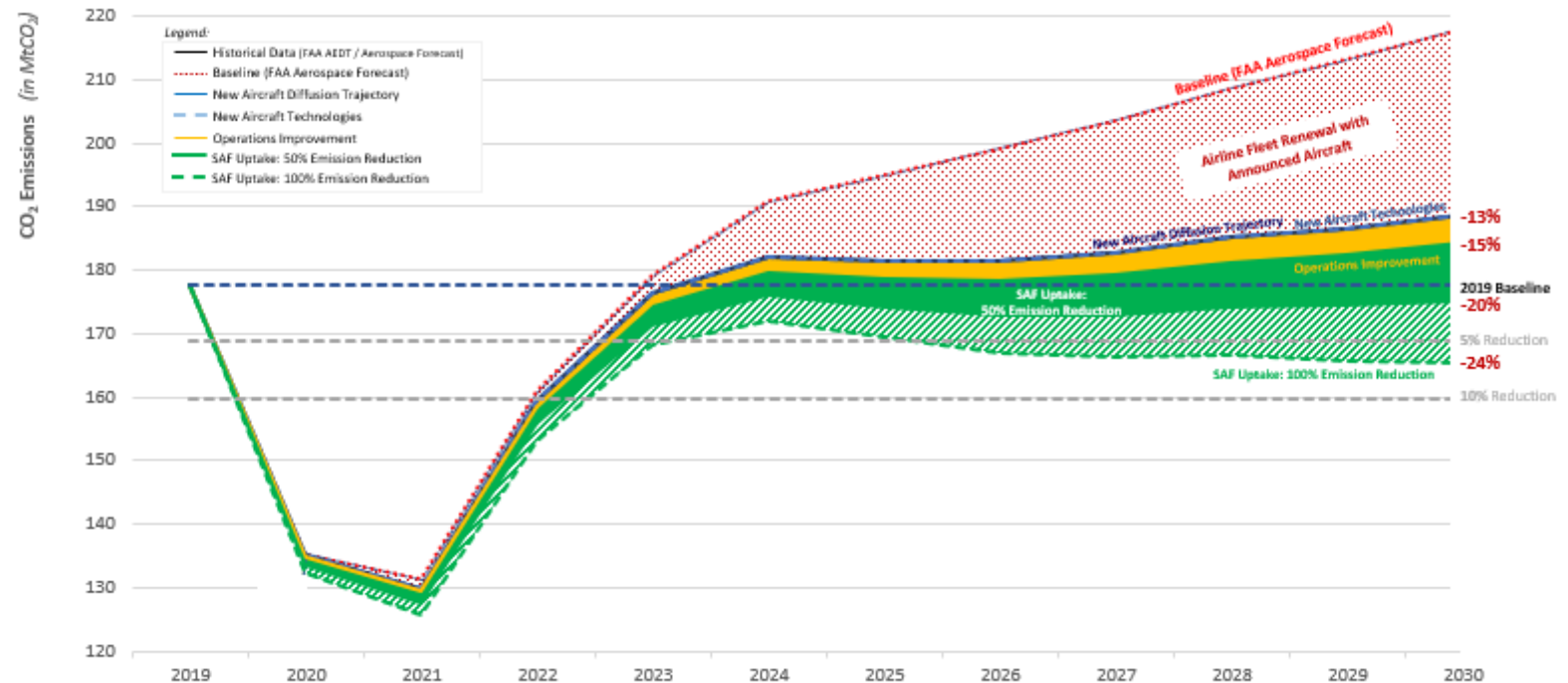
# SAF Grand Challenge Overview

Sustainable Aviation Fuel Grand Challenge (the Grand Challenge) is the government -wide effort to reduce the cost, enhance the sustainability, and expand the production and use of Sustainable Aviation Fuel (SAF).

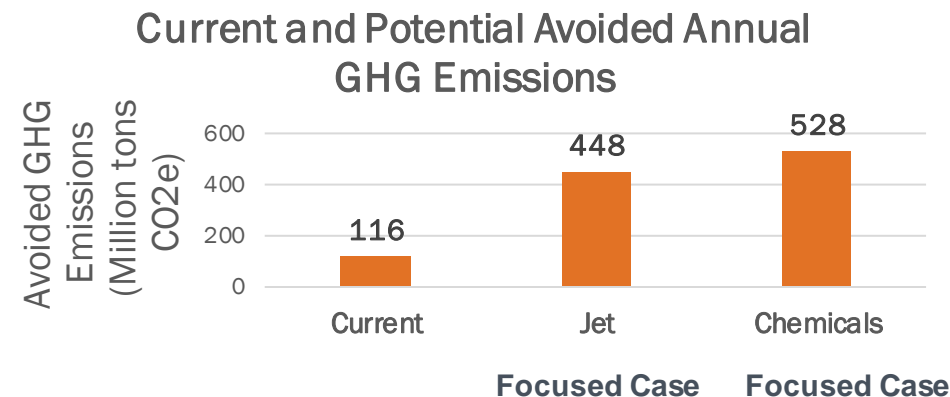
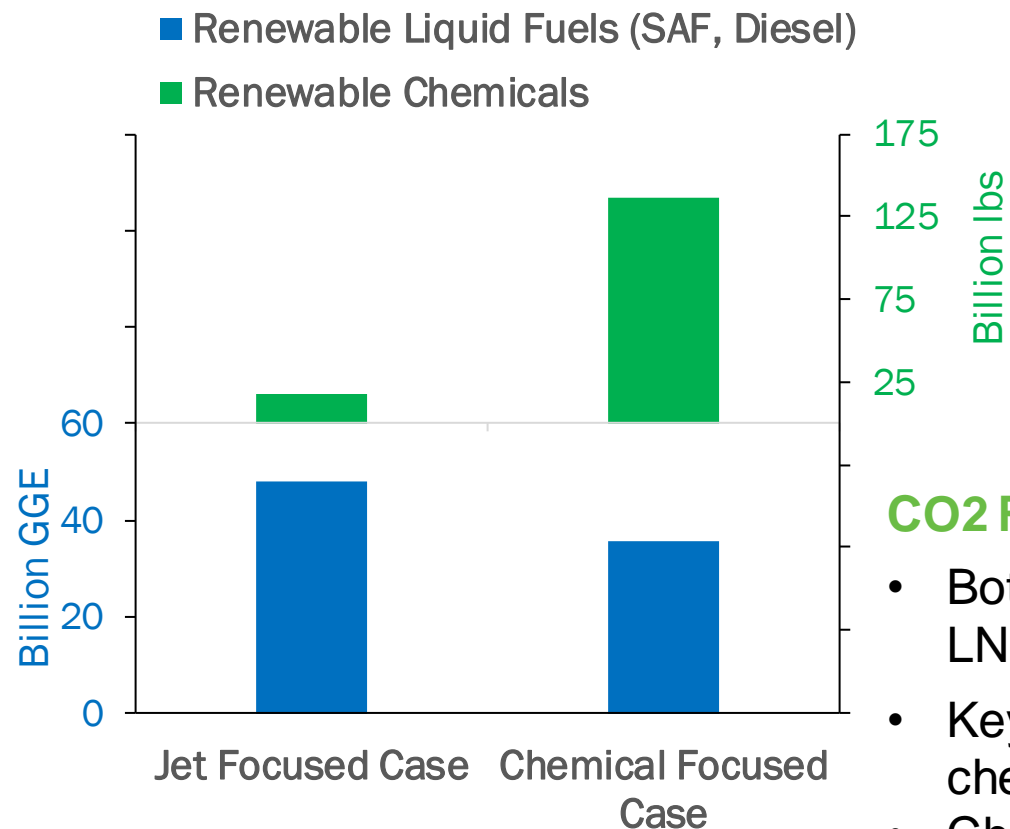
- Minimum of a 50% reduction in lifecycle greenhouse gas (GHG) compared to conventional fuel (>70% is average)
- Sufficient SAF to meet 100% of aviation fuel demand by 2050.
- Near Term Goal – 3B gallons by 2030 (20% CO<sub>2</sub> reduction)
  - Will require doubling of domestic capacity yearly

## The SAF-GC will

- Accelerate RD&D through increased focus, interagency collaboration and leveraging resources,
- Catalyze industry actions
- Coordinate government state and local policies, and
- Enhance international leadership



# Decarbonization of Industry: Chemicals



## CO2 Reduction

- Both cases include equal production of other products: (Biogas, CNG LNG, Electricity, Heat)
- Key differences between cases reside in the amount of fuels vs. chemicals produced.
- Chemicals focused case still produces >35 Billion Gallons of liquid fuel production for transportation

## Economics

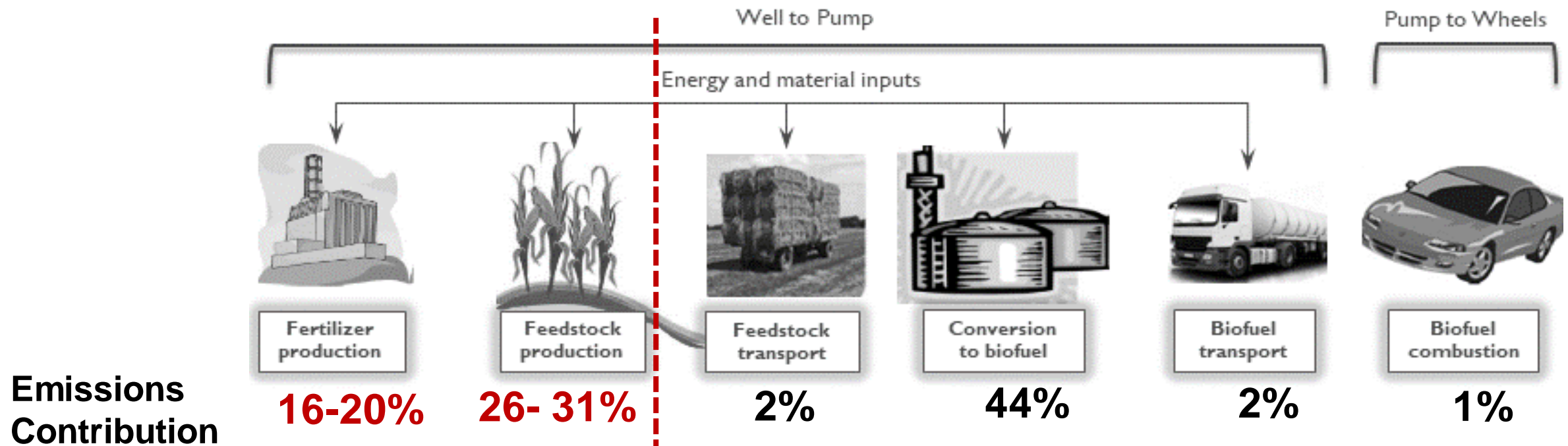
- Fuels makes up 76% of the volume of U.S. oil products and is worth \$935B.
- Chemicals make up 17% of the volume of U.S. oil products and worth \$812B.
- Optimizing Biofuels production biofuels with the development of chemical intermediates will drive down cost per gallon.



# Decarbonization of Agriculture:

## >40% of biofuels emissions are due to feedstocks

- Agriculture activities serve as both sources and sinks for GHGs
- Decarbonizing transportation and decarbonizing agriculture are intrinsically linked
- By developing tools and strategies to quantify and improve soil carbon sequestration and ecosystem services, we can produce biofuels with a lower carbon intensity



Argonne Final Report to ARPA-E (2019): *Developing a Framework for Lifecycle Analysis of Biofuels on the Farm Level*

---

**Thank You**  
**Valerie.Sarisky-Reed@EE.DOE.GOV**