

# IMPACT OF RENEWABLE DIESEL ON OLEOCHEMICALS

Racemics Meeting 28 April 2022



# US LIQUID TRANSPORTATION FUEL USAGE 2019

EIA WEBSITE

- ✓ Gasoline 130 billion gallons
- ✓ Diesel 47 billion gallons
- ✓ Aviation 18 billion gallons
- ✓ Total of Roughly 190 billion gallons annual use



# RENEWABLE LIQUID TRANSPORTATION FUELS

- ✓ Ethanol
- ✓ Biodiesel
- ✓ Renewable Diesel
- ✓ Represent about 10% of US liquid transportation fuel



# RENEWABLE LIQUID TRANSPORTATION FUELS

## ETHANOL

	Ethanol			Finished Gasoline	
	Production	Blending	Exports	Consumption	Average Ethanol Content
	<i>Million Gallons</i>				<i>%</i>
<b>2021</b>	15,015	13,937	1,252	134,829	10.34%
<b>2020</b>	13,941	12,681	1,317	123,733	10.25%
<b>2019</b>	15,778	14,552	1,467	142,712	10.20%
<b>2018</b>	16,091	14,420	1,710	143,013	10.08%
<b>2017</b>	15,936	14,485	1,390	142,976	10.13%

*Source: U.S. Energy Information Administration; numbers are subject to EIA revision*



# RENEWABLE LIQUID TRANSPORTATION FUELS

## ETHANOL

- ✓ **Corn is primary feedstock in US**
- ✓ **Flat production at ~15 billion gallons per year**
- ✓ **\$ per gallon biofuel subsidy, but difficult to calculate total credits**
- ✓ **Primary use for gasoline blending E10, E15, E85**
- ✓ **Generates 4.5 million tons of distillers grain as by-product each year**



# RENEWABLE LIQUID TRANSPORTATION FUELS

## BIODIESEL

- ✓ **Made from Methanol and Triglycerides (animal fats or vegetable oils)**
- ✓ **Flat production ~2.3 billion gallons per year; use limited by saturate levels**
- ✓ **\$ per gallon blender credit plus RIN values**
- ✓ **Majority goes to California to meet Low Carbon Fuel Standard**
- ✓ **Generates 1.4 billion pounds crude glycerin per year**



**Renewable identification numbers (RINs) are credits used for compliance, and are the “currency” of the RFS program.**

- Renewable fuel producers generate RINs
- Market participants trade RINs
- Obligated parties obtain and then ultimately retire RINs for compliance

**RINs can be traded in two forms:**

- Assigned RINs - directly associated with a batch of fuel and that travel with that batch of fuel from party to party. Purchasers obtain both the renewable fuel and RINs together.
- Separated RINs - formerly assigned with a batch of fuel, but are no longer assigned to a batch. Purchase only the RIN.

**Examples of typical RIN transactions include:**

- Generate - when a fuel is produced, a RIN is generated
- Buy - when an assigned/separated RIN is bought/traded by a buyer from a seller
- Sell - when an assigned/separated RIN is sold/traded by a seller to a buyer
- Separate - when a RIN is separated from the fuel to which it was originally assigned
- Retire - when a RIN is used to demonstrate compliance, or required to be retired for other purposes

# RENEWABLE LIQUID TRANSPORTATION FUELS

## RENEWABLE DIESEL

- ✓ **RD is growing with US capacity doubling annually through 2024**
- ✓ **Feedstock more flexible than biodiesel – most any triglyceride will work**
- ✓ **\$ per gallon blender credit for ~2 billion gallons plus RIN values (\$0.40 - \$1.10 per gallon)**
- ✓ **Used cooking oil and tallow have most favorable carbon intensity scores**
- ✓ **Does not generate much in way of byproducts relative to biodiesel**





# RENEWABLE LIQUID TRANSPORTATION FUELS

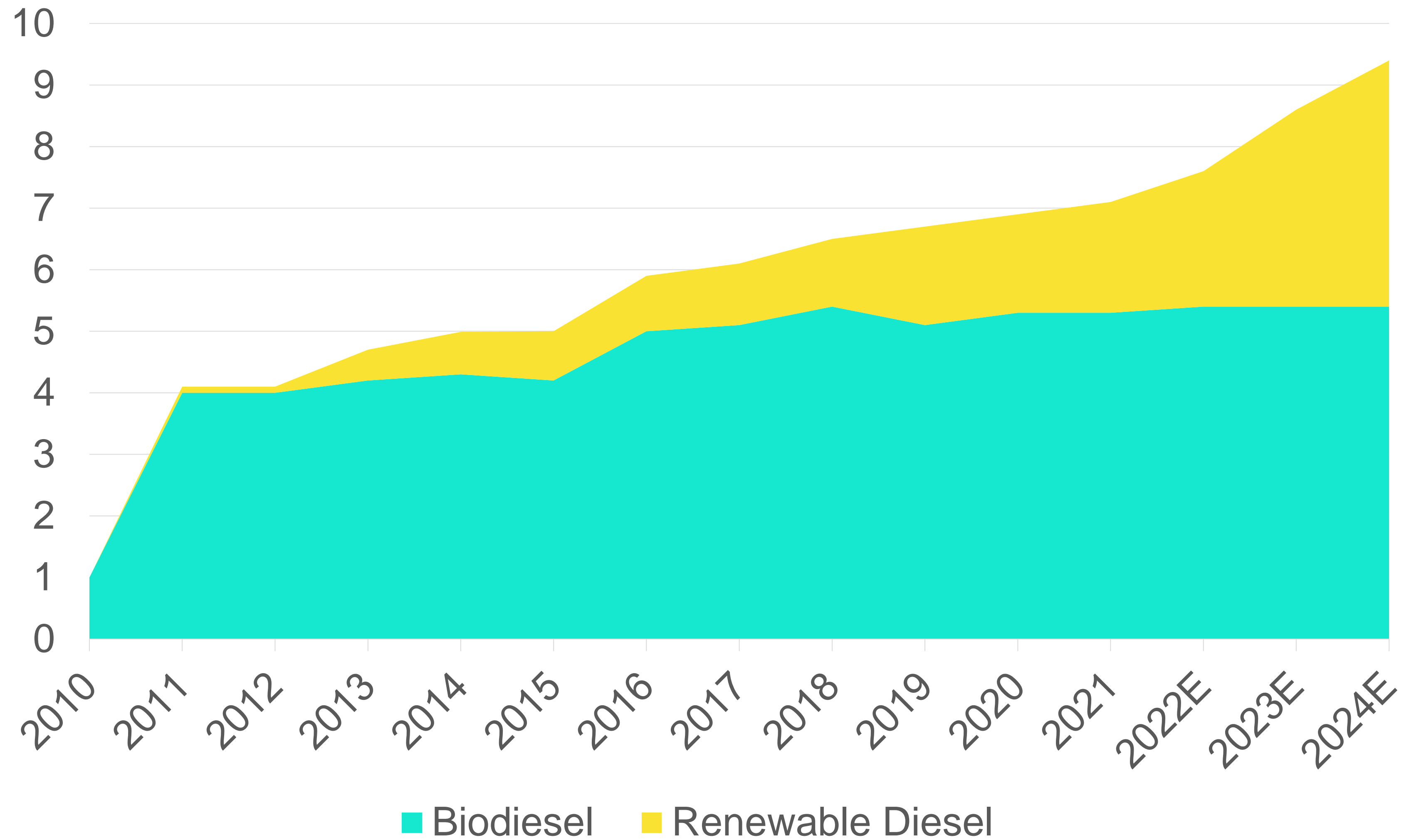
## California LCFS Carbon Intensity Scores for Renewable Diesel

<b>Feedstock</b>	<b>CI Score</b>
UCO	20.8
Distillers Corn Oil	32.8
Tallow	36.3
Soybean Oil	55.2

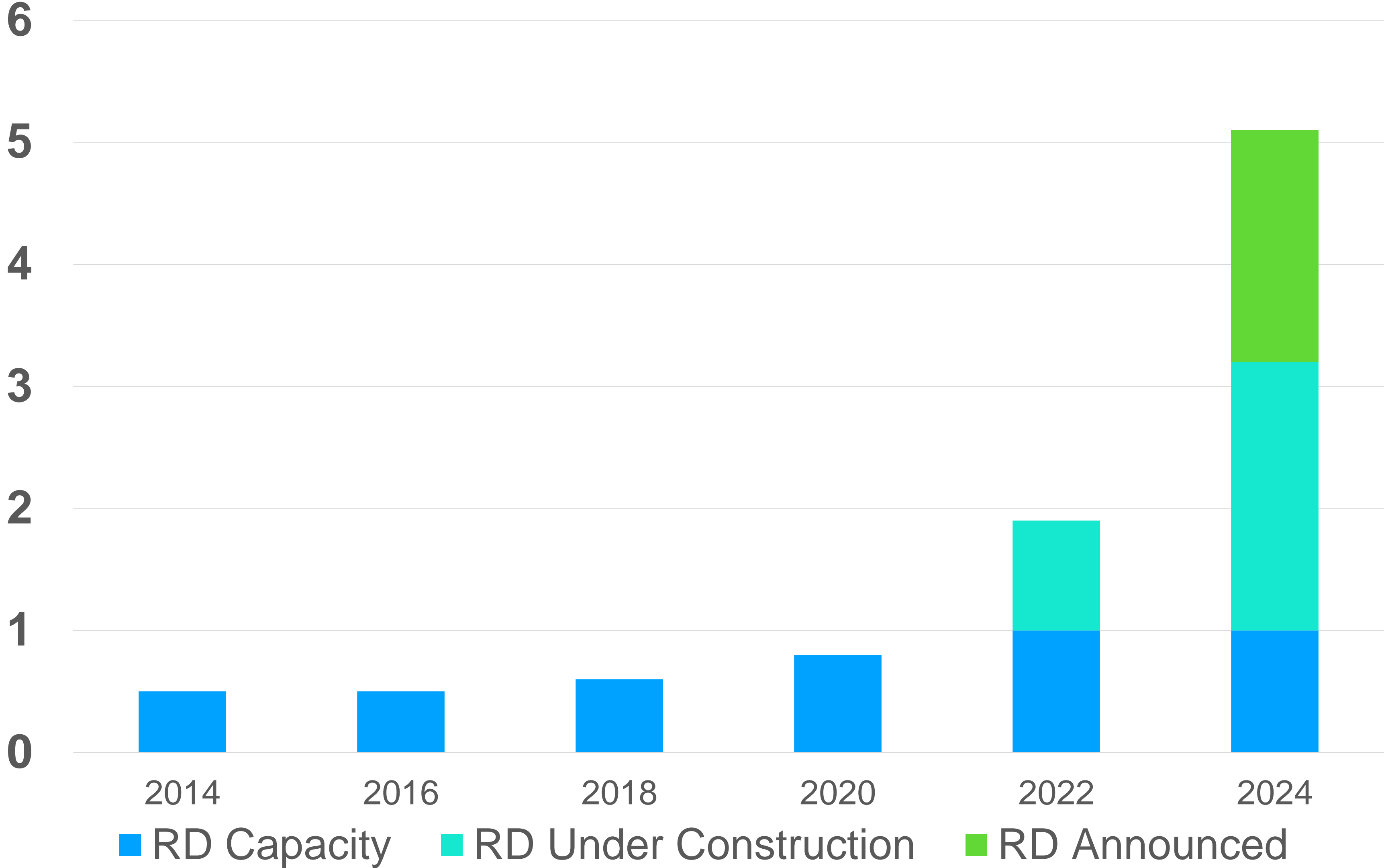
**EPA is currently working on RIN for Canola Oil**



# Annual US Production in million metric tons 2010 - 2024



# Existing and Expected RD Capacity (billion gallons)



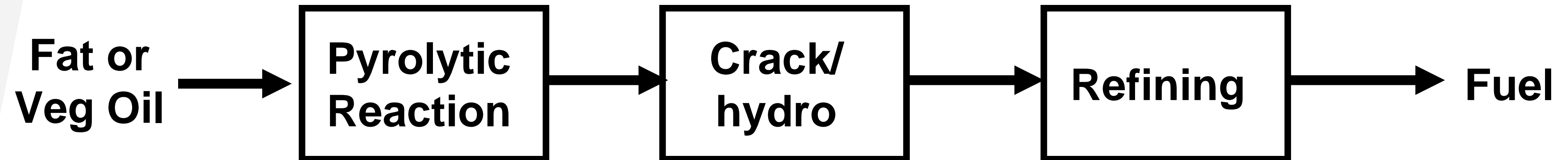
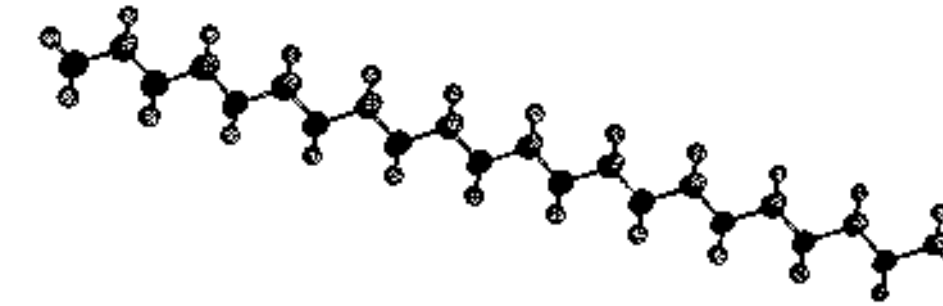
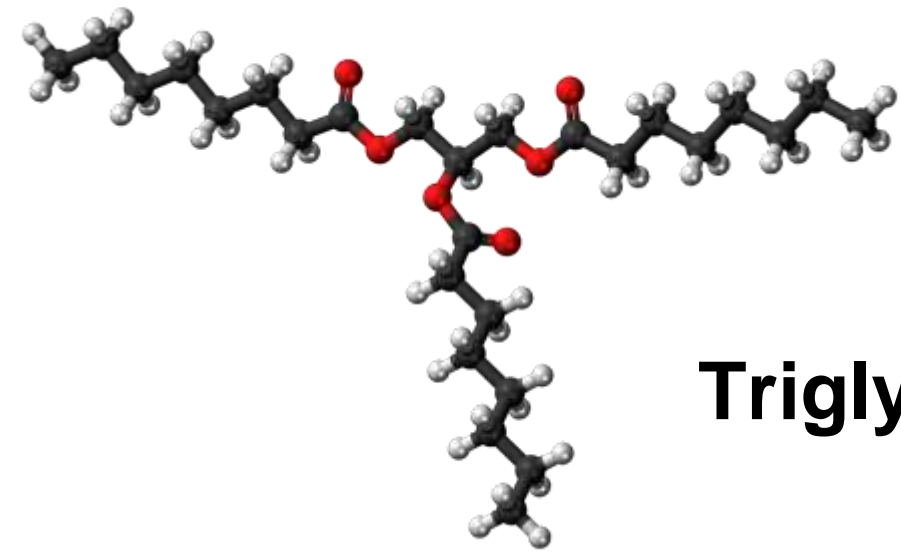
## RENEWABLE DIESEL

### SELECTED MAJOR PROJECTS

- ✓ Diamond Green – Valero/Darling JV to reach 1.2 billion gallons in 2023
- ✓ Neste has 1.5 billion gallons globally – buying US feedstock traders/suppliers
- ✓ Marathon/ADM soy based venture for up to 0.7 billion gallons
- ✓ Tyson/Jacob Stearn & Sons JV
- ✓ Heartwell Renewables – Cargill/Love's JV
- ✓ Chevron buying REG



# RENEWABLE DIESEL PROCESS



# SUSTAINABLE FEEDSTOCKS FOR RENEWABLE DIESEL

Typically, renewable or recyclable Animal fats or Plant oils

Agriculture - Soy, Corn, Canola,  
Palm and Rape Seed Oils

Recycled products - Recycled  
cooking oil, byproducts of  
animal production, such as beef  
tallow.



# Beef fat, tallow



# Soybean Oil





# Palm Oil ?



## SOYBEAN OIL

- ✓ One bushel of soybeans produces 11 pounds of oil and 48 pounds of meal
- ✓ 4.1 billion bushels produced in US in 2021. About 40% is exported.
- ✓ If all 4.1 billion bushels crushed, it would yield 6.1 billion gallons of soybean oil
- ✓ If no exports, another ~2 billion gallons of oil could be generated
- ✓ What to do with the extra soybean meal??



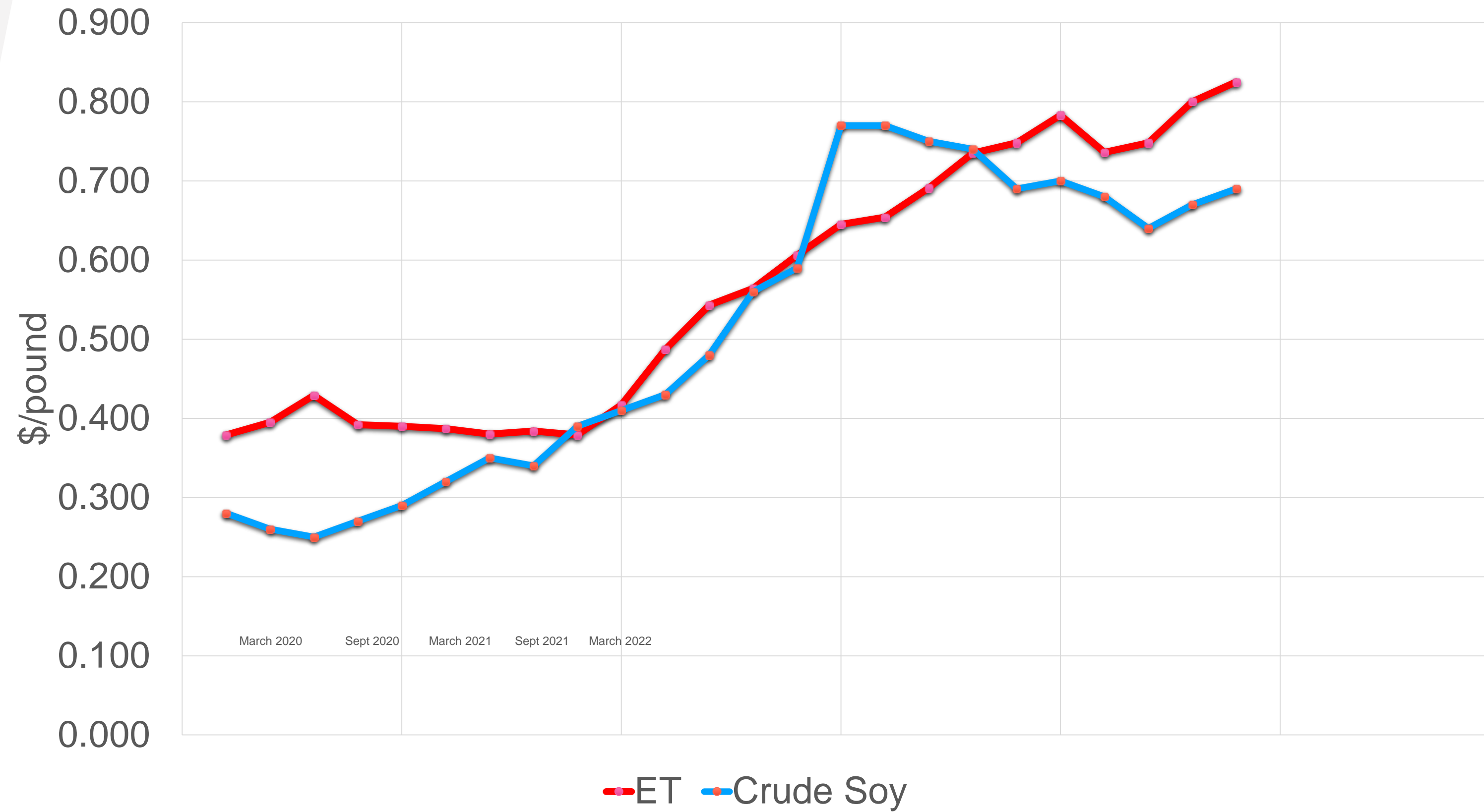
## ECONOMICS – FEEDSTOCK SUPPLY

- ✓ Tallow supply is very flat and cannot be readily increased. It grows about 2% per year representing a total availability of 0.8 billion gallons per year.
- ✓ Soybean oil can possibly add 2 billion gallons if crushing capacity in place.
- ✓ Refined vegetable oils are mostly > \$1 per pound (or \$7 per gallon). Corn oil approaching \$1.70 per pound.
- ✓ UCO and animal fats have a low CI score which makes them most attractive in CA and OR markets. Tallow and Yellow Grease have more than doubled in cost in the past year alone.
- ✓ 23 billion gallons of palm oil were produced in 2021, but it is unpopular in Europe and in some California circles.



# CRUDE SOY OIL AND TALLOW PRICES

Edible Tallow and Soy Oil  
March 2020 - March 2022



## IMPACT OF RENEWABLE DIESEL ON OLEOCHEMICALS

- ✓ Domestic production of stearics and oleics will continue to rise in price as the scarcity of feedstocks intensifies. This will affect anything made from fatty acids or fatty alcohols.
- ✓ Given the magnitude of import supply chain limitations, there is limited potential from additional supply from abroad.
- ✓ Unless petroleum diesel surpasses the ~\$9 per gallon level, subsidies and renewable volume obligations will need to cover the cost gap.



## REFERENCES

US EPA website

USDA website

EIA website

Render Magazine – February 2022

North American Renderers Association

United Soybean Board

California Air Resources Board



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