Bioenergy Market Situation & Outlook

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Biodiesel and Renewable Diesel

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Biodiesel and Renewable diesel

- Similarities
  - Both help to conserve petroleum fuels
    - Petroleum fuels sometimes called “fossil” fuels
  - Both fuels are derived from biological sources
  - Both can help the environment by lowering greenhouse gases with a lower carbon footprint than using diesel refined from oil
  - Both can help relieve capacity pressure in oil refineries
  - Both are part of the Renewable Fuel Standards (RFS)

- Differences
  - There are significant differences between the products

Biodiesel

- Produced through a chemical process known as transesterification
  - Glycerin is separated from fat or vegetable oil.
  - Process involves reacting lipids, typically vegetable oils, animal fats, or recycled greases, with an alcohol (usually methanol) in the presence of a catalyst to produce biodiesel (fatty acid methyl esters) and glycerol as a by-product.

- Biodiesel can be used in its pure form (B100) or blended with petroleum diesel at any concentration in most diesel engines.
  - Biodiesel is often used in blends with petroleum diesel; common blends include B20 (20% biodiesel, 80% petroleum diesel) and B5 (5% biodiesel), due to its compatibility with diesel engines without significant modifications.
  - However, higher concentrations of biodiesel can require engine and infrastructure adjustments to avoid issues related to fuel viscosity and cold weather performance.

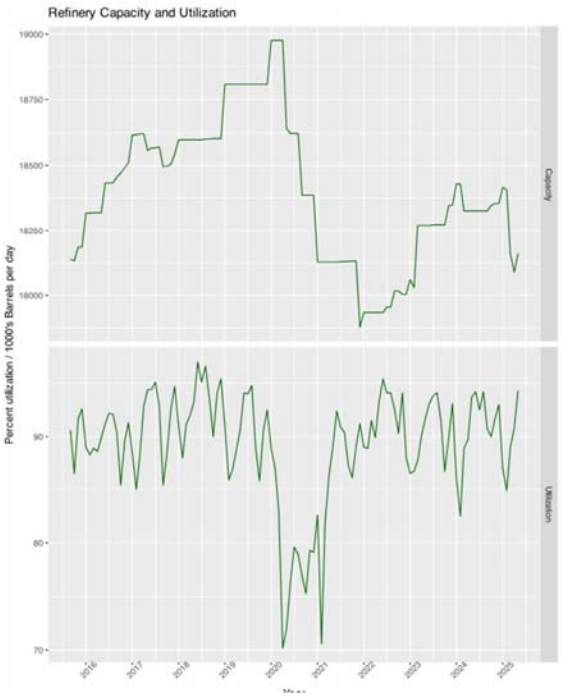
- Biodiesel blends are denoted by the letter "B" followed by a number that represents the percentage of biodiesel in the blend. The rest of the blend typically consists of petroleum diesel.

Renewable diesel

- Produced through a different set of processes, such as hydrotreating, gasification, and pyrolysis, which involve more complex chemical reactions and higher pressures and temperatures.
  - The most common process, hydrotreating, involves removing oxygen from the triglycerides in fats or vegetable oils, resulting in a hydrocarbon similar to petroleum diesel.
  - This process not only produces renewable diesel but also yields propane and naphtha as by-products.
- Renewable diesel is a pure hydrocarbon and is chemically similar to petroleum diesel
  - **can be used in existing diesel engines without modifications**
  - does not have the same issues with NOx emissions or compatibility.
- Renewable diesel is better than biodiesel
  - Renewable diesel has a higher cetane number than biodiesel which leads to better combustion efficiency and engine performance.
  - Also has a lower cloud point, making it more suitable for use in colder climates compared to biodiesel.
  - Also better environmentally

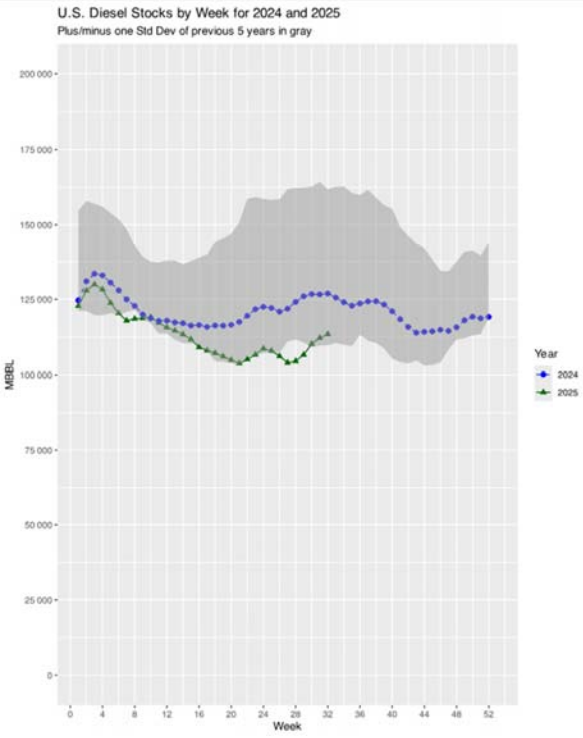
Challenges with both green diesel products

- Feedstock available
  - Similar to ethanol competing for corn
  - Renewable diesel has major advantage here
- Production costs
  - Currently biodiesel has an advantage
  - Renewable diesel is expected to erase any cost advantage of biodiesel
- Infrastructure compatibility
  - Biodiesel is not 100% compatible especially in B100 form
    - Requires blending in most cases
  - Renewable diesel is nearly identical to petroleum diesel so not really an issue.



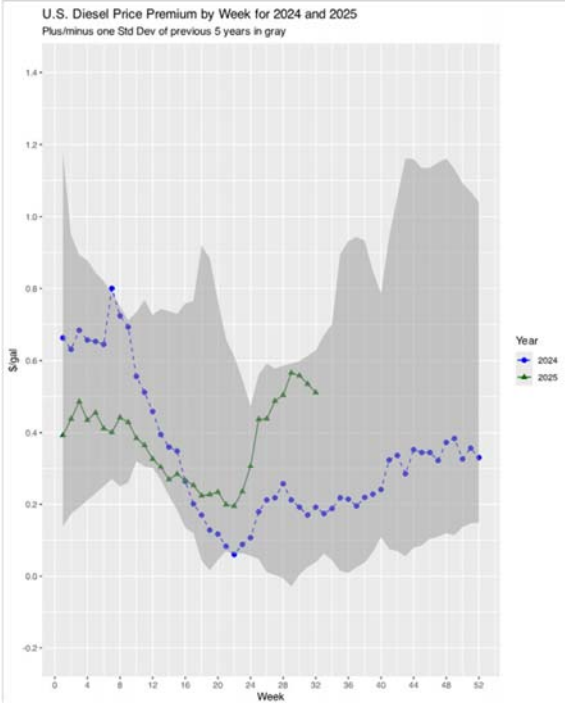
Current Oil and Diesel Situation

- Current refinery capacity declined during covid
  - Some bounce back
  - Capacity continues to drop as outdated refineries are never replaced
- Utilization remains very high (95%)
- EVs help with need for oil and diesel
- Biodiesel and renewable diesel help as well



Low Diesel Stocks

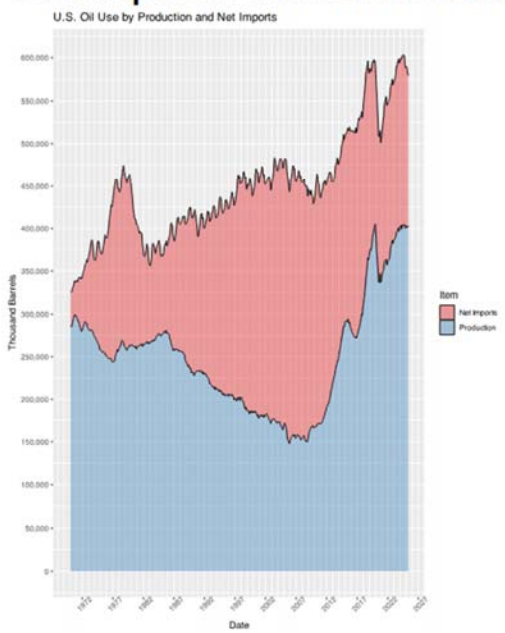
- Nearly every year of diesel stocks at bottom of 5 year range
  - The 5 year range is slowly moving lower
- Low stocks mean diesel price premiums relative to gas
- More price spikes
  - One problem away from a price disaster
- Reduction in refinery capacity means this situation may never improve

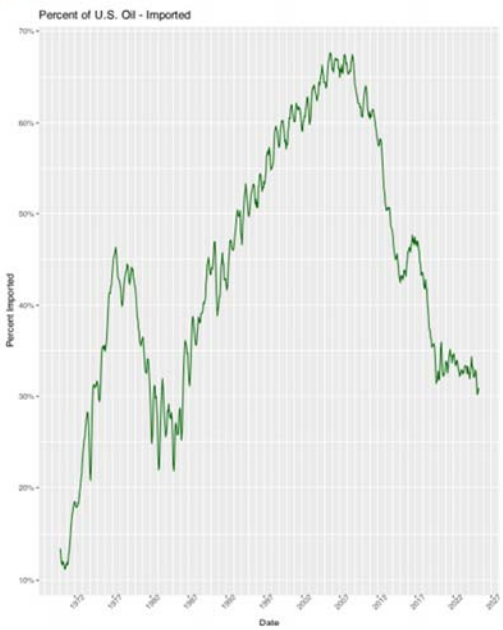


Low Diesel Stocks = Price Premium

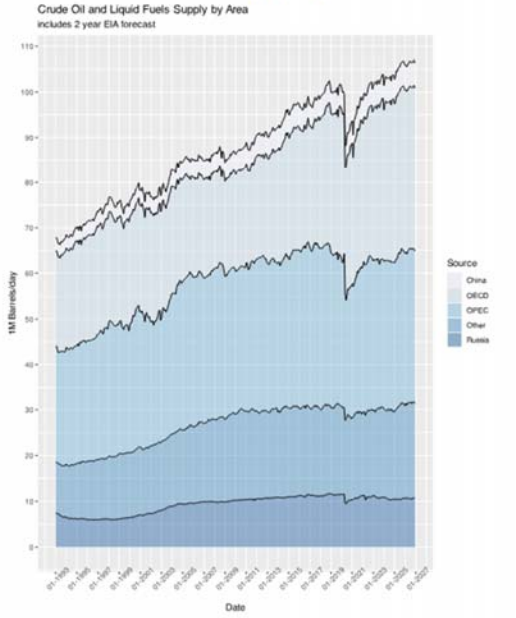
- A $0.50 to $0.60 premium to gasoline is not unusual
- Pattern developing with price premium
  - Premium is smallest at early summer
    - Start of vacation season
  - Premium rises until late in the year and then starts to decline

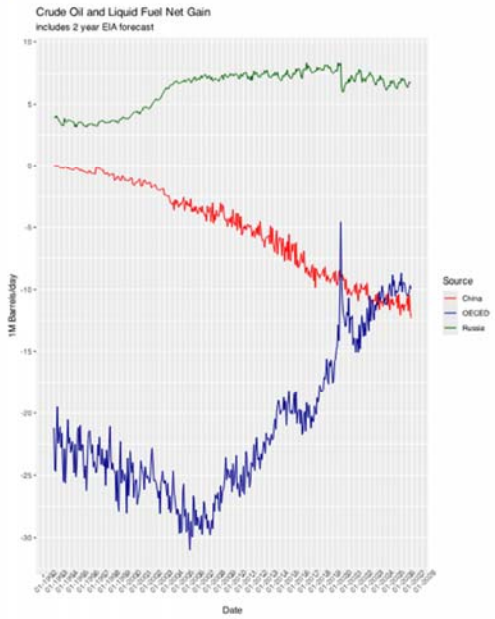
Oil imports and domestic use



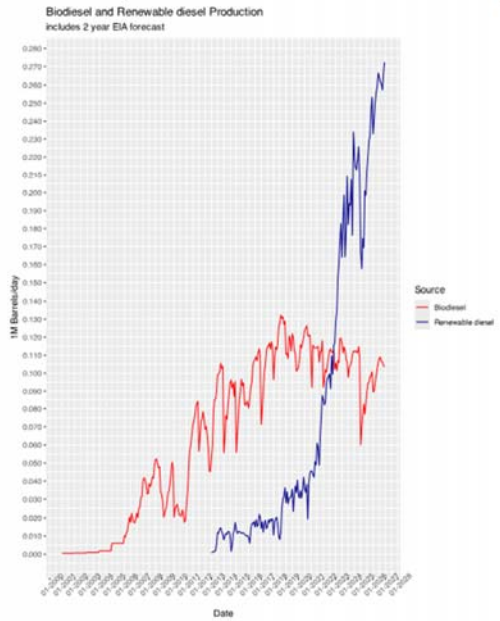


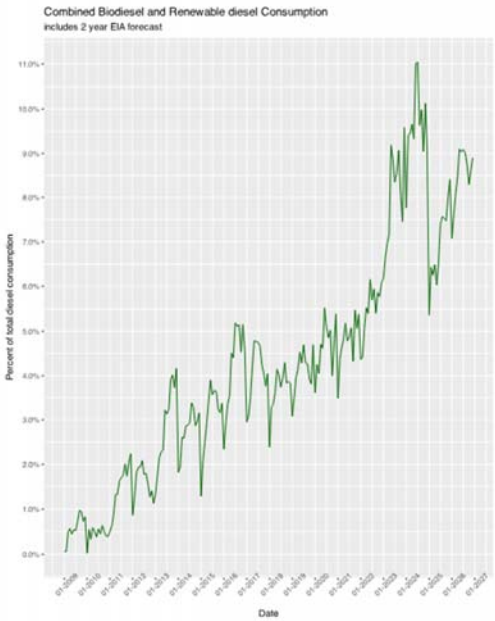
World oil supply and demand



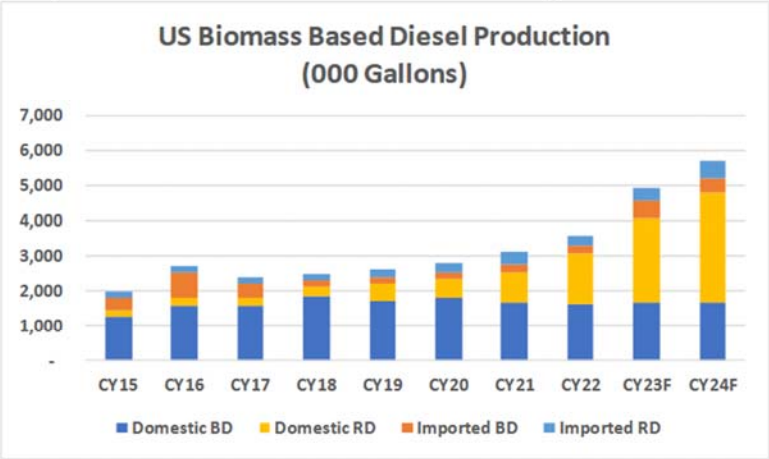


Biodiesel production and consumption





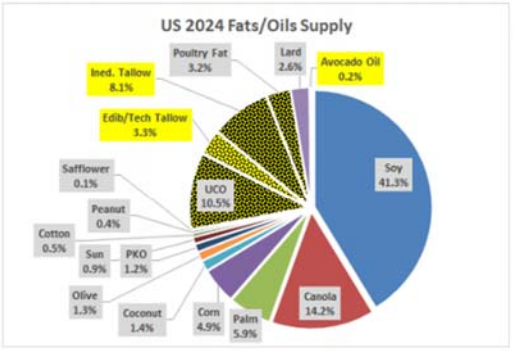
- BD growth flat, while RD growth surges
- Imports remain relatively small



"BD" – Biodiesel, produced by mixing fats & oils with methanol
"RD" – Renewable diesel, produced via hydrotreating

From Bill Lapp
– Advanced Energy Solutions

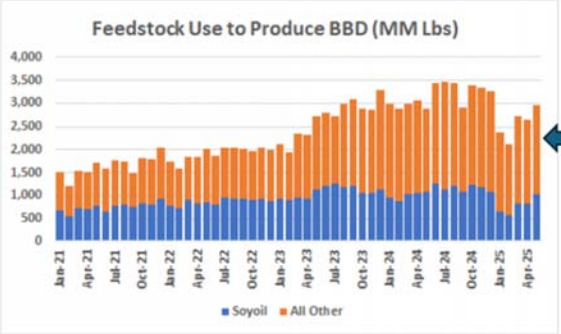
US Fats/Oils Supplies



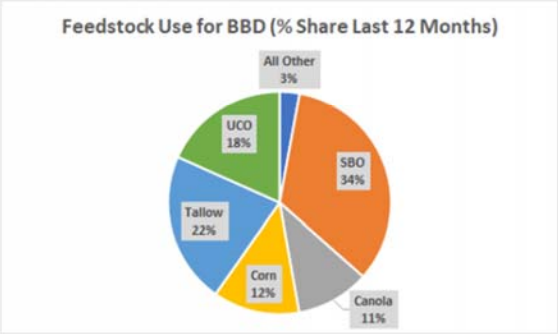
- US fats/oils supply (domestic and imports) totals 69 B pounds
- Food use of fats/oils totals 25 B pounds
  - Very inelastic demand
  - Dominated by soy and canola

***AES Opinion*: The food industry will never be outbid for fats and oils by the biofuel industry**

From Bill Lapp
– Advanced Energy Solutions



Surging imports of used cooking oil and tallow



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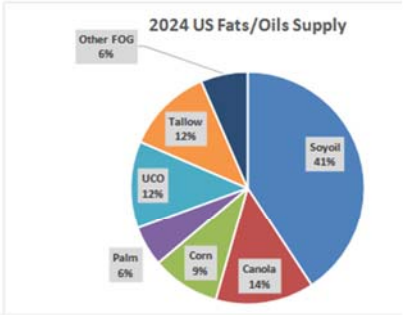
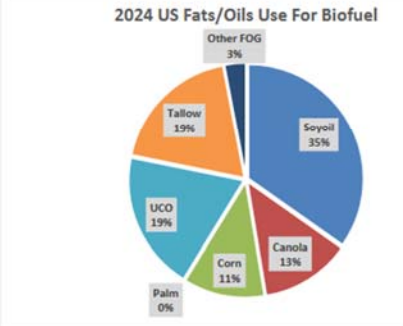
– Advanced Energy Solutions

Use of Fats/Oils for Biofuels

C24 US Fats/Oils Supply & Usage (MM Pounds)					
	Produced	Import	TTl Supply	Biofuel	Supply Share Biofuel
Soyoil	27662	614	28276	13237	47%
Canola	1933	7516	9449	4805	51%
Corn	6434	102	6536	4331	66%
Palm	0	3855	3855	0	0%
UCO	3000	5427	8427	7390	88%
Tallow	6383	1931	8314	7164	86%
Other FOG	3974	524	4498	1143	25%
TTL Above	49386	19969	69355	38070	55%





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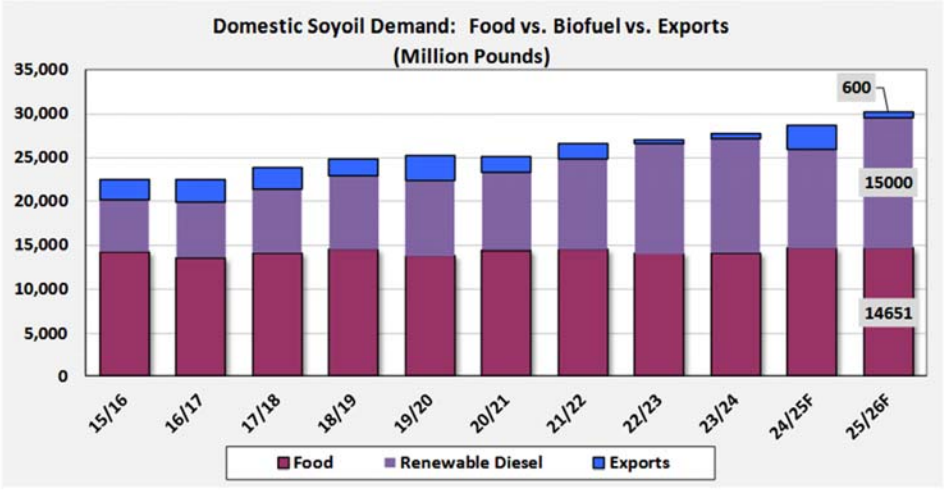
Soyoil Usage



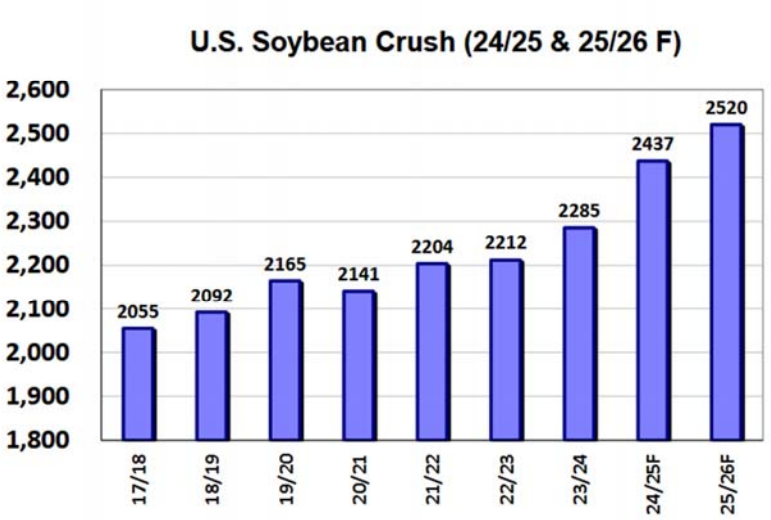
Exports: variable

Biofuel use: growing, now larger than food use

Food use: large but very stable

From Bill Lapp
– Advanced Energy Solutions

Rapid Growth in Soy Crush Capacity - Likely to continue through 26/27



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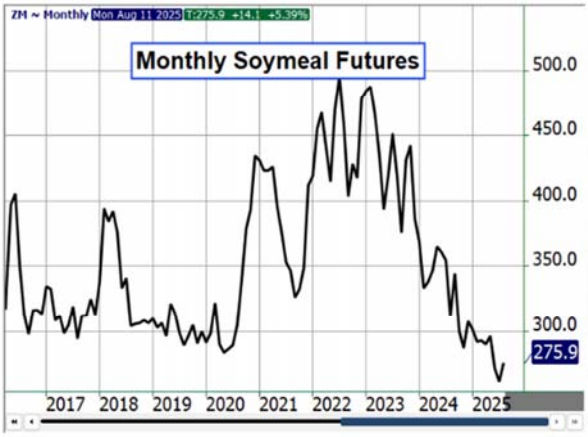
What Will We Do With All The Soymeal?



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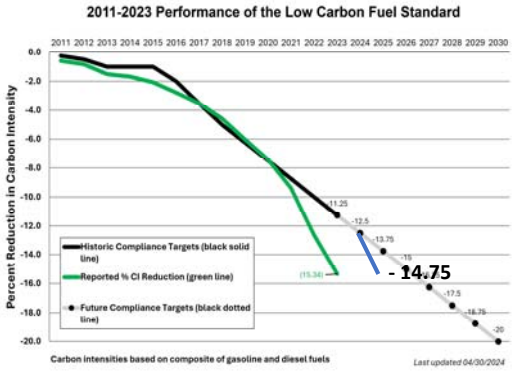
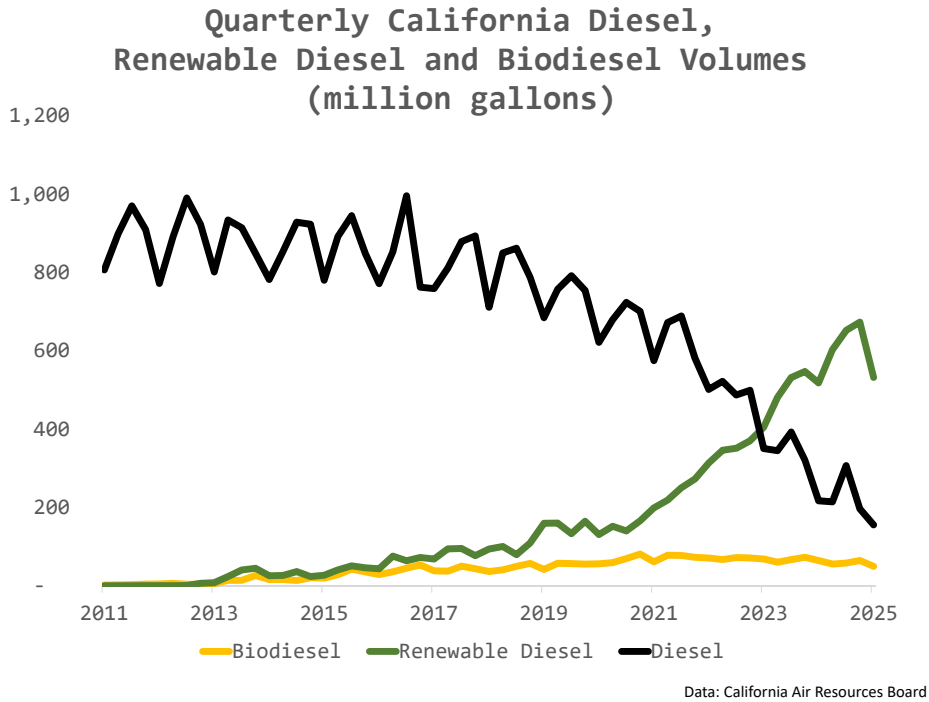
California's Low Carbon Fuel Standard (LCFS)

- Mandates reduction in greenhouse gas (ghg) emissions from transportation fuels
- Uses cap-and-trade that allows market to find best solution
- Biofuels, especially renewable diesel, play by far the largest role



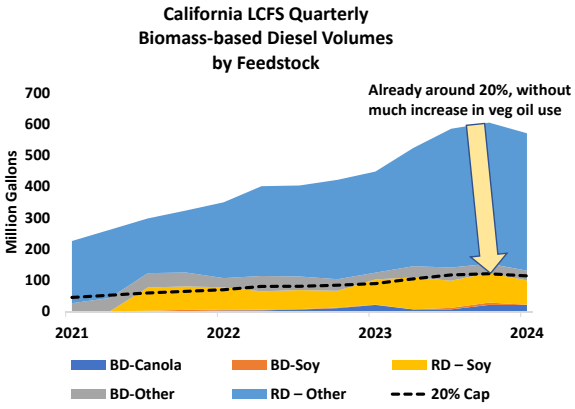
NDSU | EXTENSION AGRIBUSINESS



Data: California Air Resources Board

California's Low Carbon Fuel Standard (LCFS)

- **Increase target from a 20% reduction to a 30% reduction for 2030 relative to 2010**
- **20% cap on vegetable-based biofuels by volume**
- **Traceability to point of origin**



NDSU EXTENSION AGRIBUSINESS

Data: California Air Resources Board

Renewable Fuel Standard

- Mandates biofuel use in US
- Requires blenders and refiners to acquire **RINS** (renewable identification numbers) by using biofuel or trading
- June proposal 2026 and 2027 volumes +2 billion gallons

Actual (2023-2025) and Proposed (2026-2027) RIN volumes

	2023	2024	2025	Proposed 2026	Proposed 2027
Cellulosic biofuel	0.84	1.09	1.38	1.3	1.36
Biomass-based diesel*	*2.82*	*3.04*	*3.35*	7.12	7.5
Advanced biofuel	5.94	6.54	7.33	9.02	9.46
Renewable fuel	20.94	21.54	22.33	24.02	24.46

*gallons through 2025, RINs in 2026 & 2027

NDSU EXTENSION AGRIBUSINESS

45Z Clean Fuel Production Tax Credit

- Provides tax credit to producers of clean fuel
- Replaced biodiesel (blending) credit
- Credit is based on carbon intensity of the fuel (up to $1 per gallon)
- Carbon intensity includes feedstock production/on-farm activities

45Z Developments/OBBB

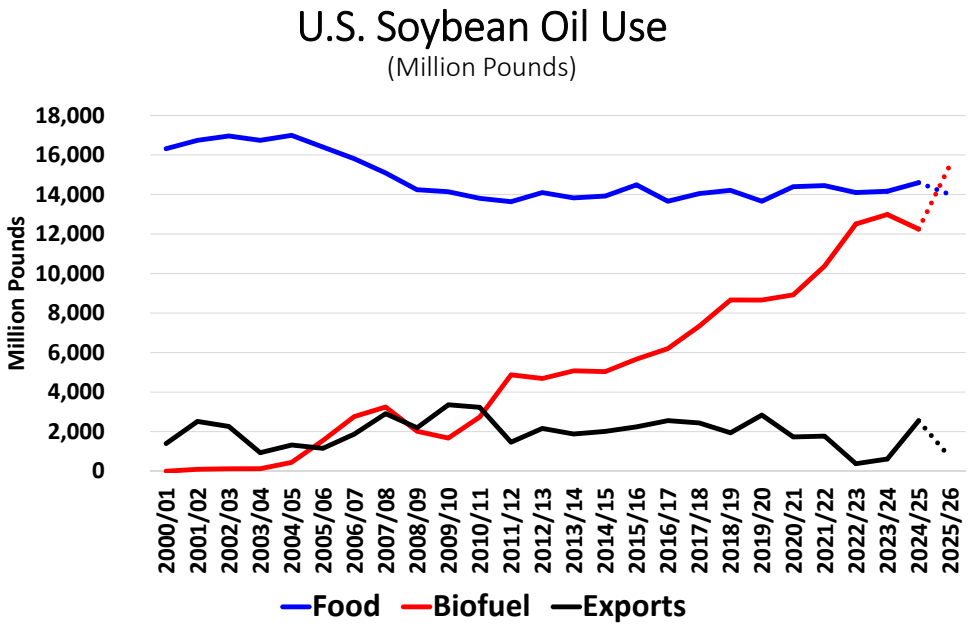
- Program extended from end of 2027 to end of 2029
- Requires feedstock be produced in US, Canada or Mexico
- Land-use change no longer included
- SAF bonus credit is eliminated

45Z What to Watch For…

Official guidance for on-farm practices

- What practices are going to be incentivized?
- How large will tax credits be for each practice?
- What will be required for reporting and verification?

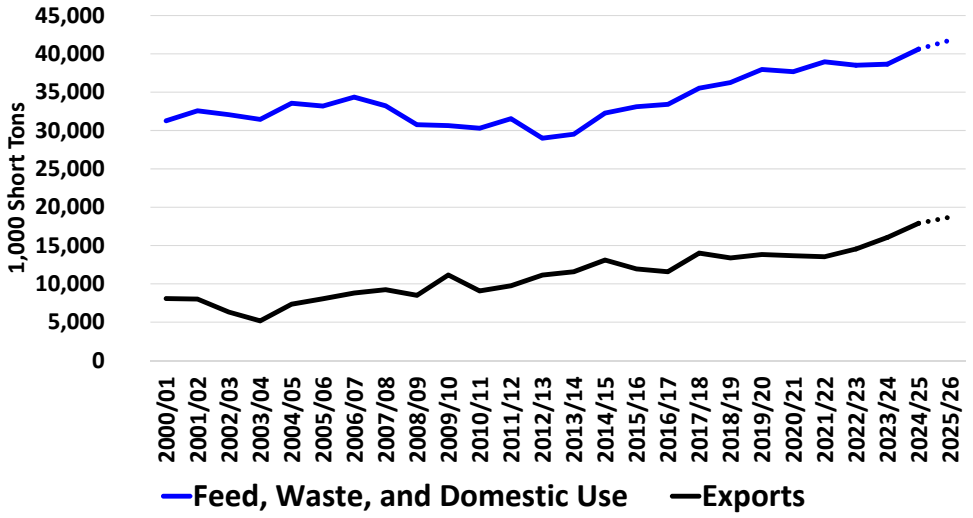
NDSU | EXTENSION AGRIBUSINESS



Aug. 12, 2025, WASDE Report and PSD Online

U.S. Soybean Meal Use

(1,000 Short Tons)



Aug. 12, 2025, WASDE Report and PSD Online

U.S. Ethanol Corn

Trends in Market Prices, Costs & Profitability

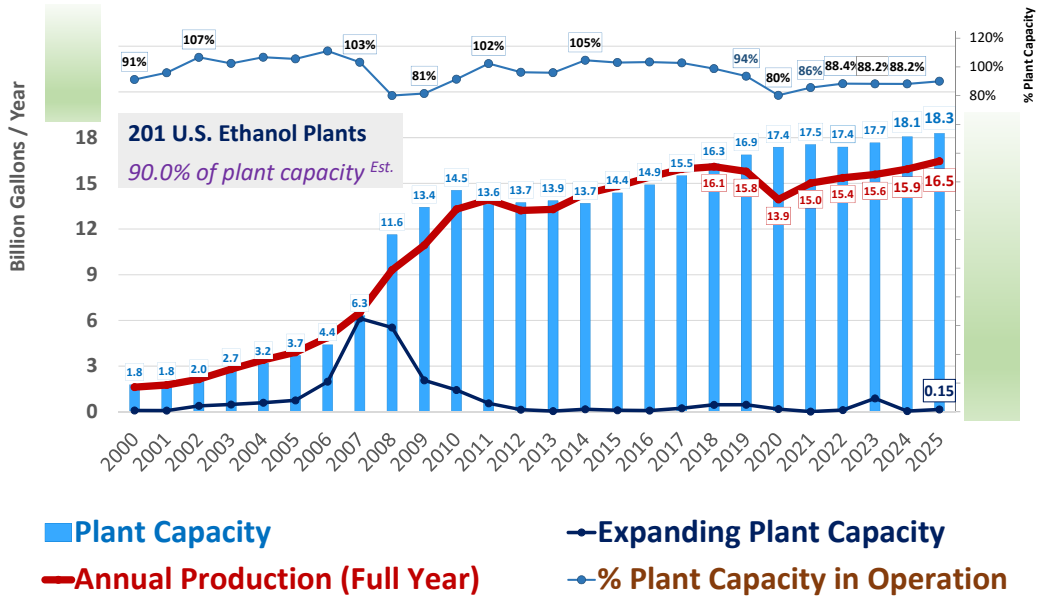
KSU www.AgManager.info & WILL Radio (Illinois)

Thursday, August 21, 2025

Daniel O'Brien, Ph.D.
Extension Agricultural Economist
Kansas State University

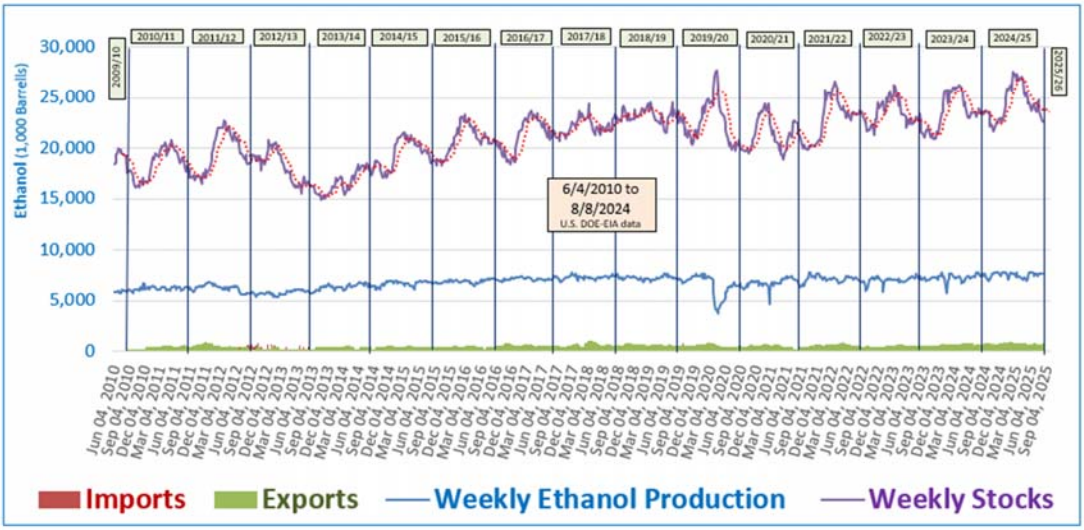
U.S. Ethanol Capacity & Production

USDA ERS Biofuel Statistics & Renewable Fuels Association – August 19, 2025



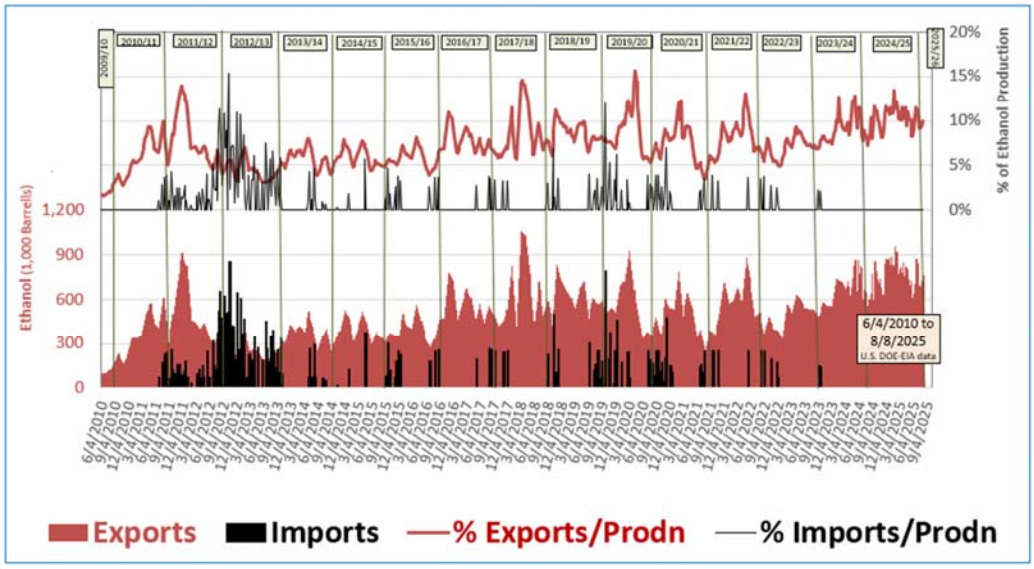
U.S. Ethanol Production & Stocks *Weekly*

Based on U.S. DOE – EIA on U.S. Ethanol Industry Trends as of August 8, 2025



U.S. Ethanol Foreign Trade *Weekly*

Based on U.S. DOE – EIA on U.S. Ethanol Industry Trends as of August 8, 2025



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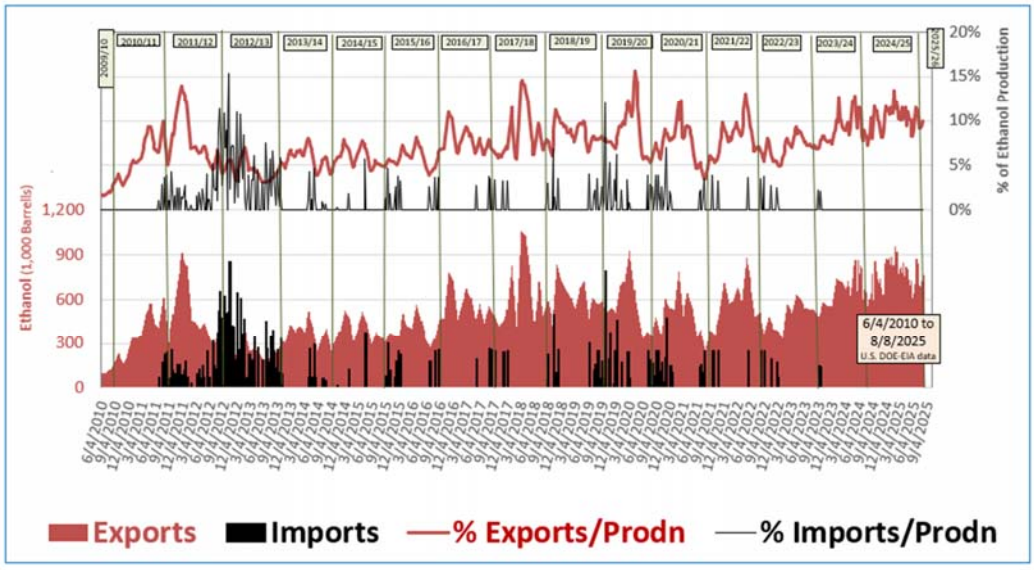

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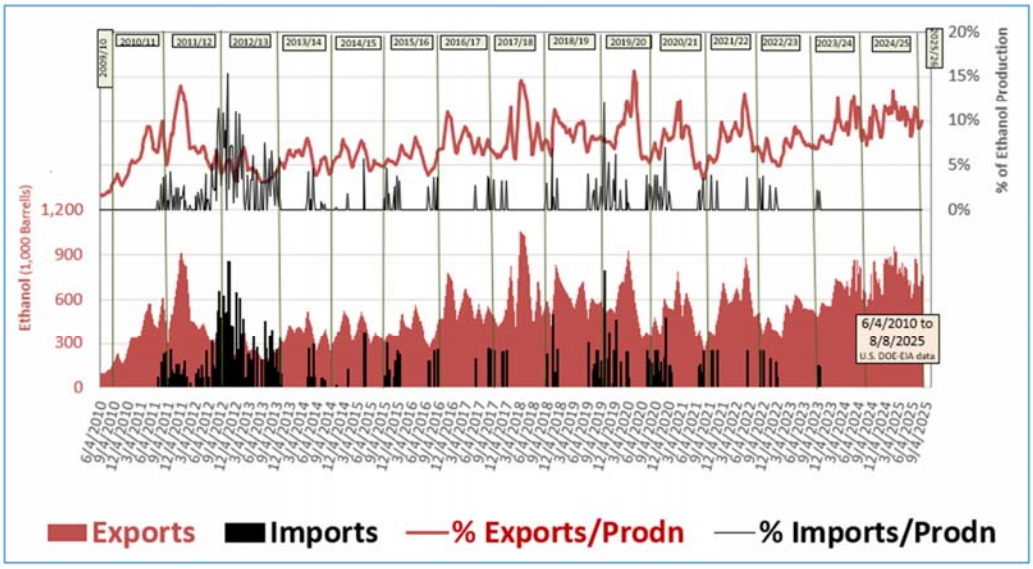
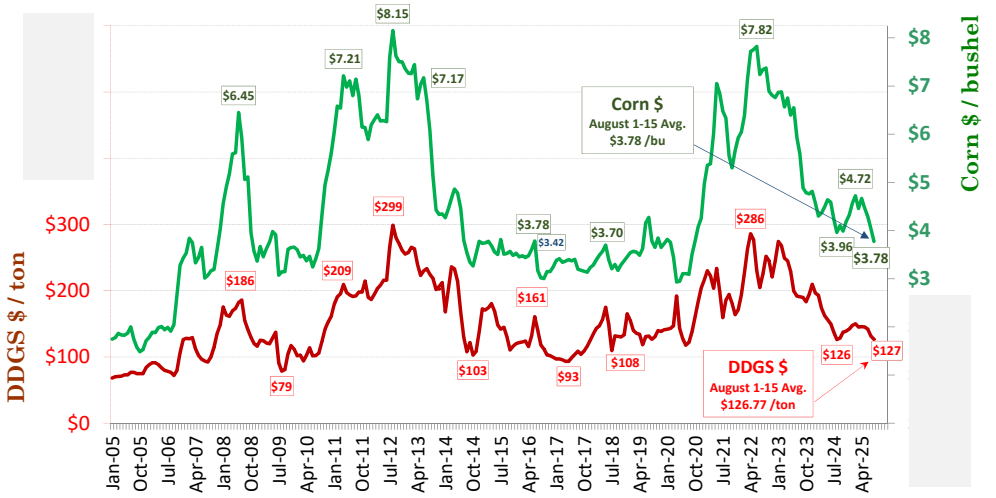


Ethanol DDGS & Corn Input Prices

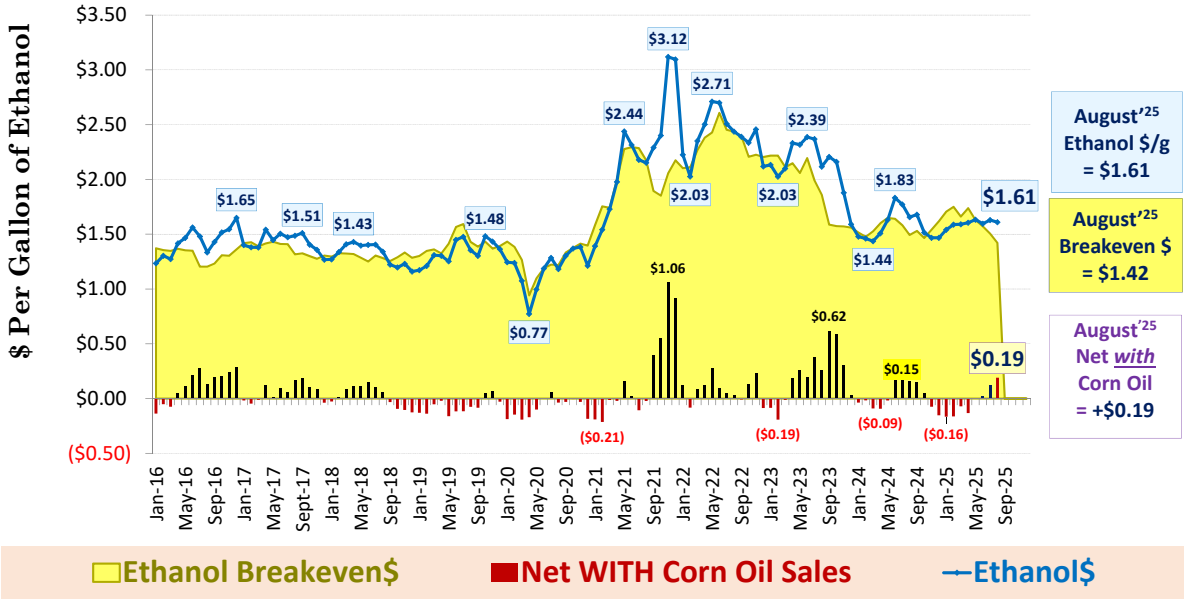
ISU Ethanol Plant Model (January 2005 – August 15, 2025)



—DDGS $/ton —Corn $/bu

Ethanol Price, Cost & Profit/Loss

ISU Ethanol Plant Model (January 2016 – August 15, 2025)



Ethanol Revenues & Net Returns

ISU Ethanol Plant Model (January 2016 – August 15, 2025)