California Low Carbon Fuel Standard Workshop

APRIL 10, 2024

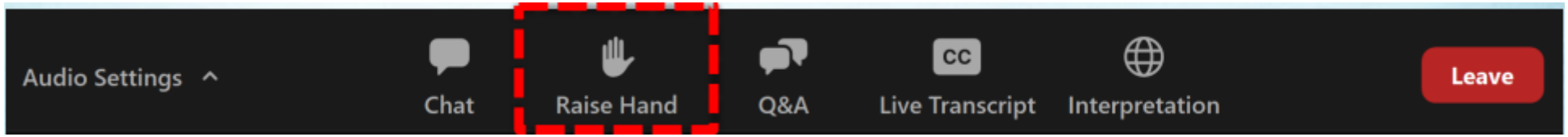
CALIFORNIA
AIR RESOURCES BOARD

Workshop Overview

- Morning, 9am-12pm
  - EJAC Presentation or Comments
  - Staff Presentation
    - LCFS support for CA climate, air quality, and ZEV goals
    - Rulemaking process and key concepts
    - Modeling updates and renewable diesel volume projections
    - Sustainability guardrails
  - Public comments (in-person and Zoom)
- Break, 12-1pm
- Afternoon
  - Public comments continued (in-person and Zoom)

Public Comments

- Process
  - Comments will be taken by in-person attendees and virtually through Zoom
  - 3 minutes per comment
  - Staff will make every effort to call on commenters in the order they signal they would like to comment or raise the hand on Zoom
- Zoom Orientation
  - “Raise Hand” to signal that you’d like make a comment
  - Zoom phone participants may dial #2 to raise your hand
  - Staff will inform Zoom phone participants when they are unmuted during public comment
  - Dial *6 to mute or unmute



The Road
to Zero Emissions

CARB has put a roadmap in place to drastically reduce our dependence on petroleum in the transportation sector by 2045.

AB 32

Requires we cut GHGs.

To reach goals, fuel use must be cut by 94%.

How cuts happen?

Zero emission cars, trucks and fuels.

ACT **ACC** **ACF**

CARB rules that make that possible:

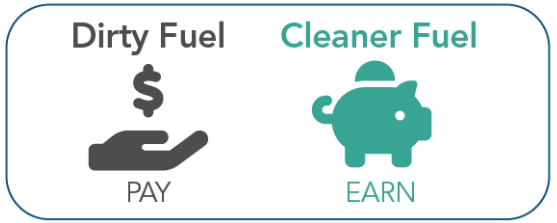
Advanced Clean Trucks, Advanced Clean Cars, Advanced Clean Fleets

- ACT: Phases out sale of most fuel-powered trucks by 2035
- ACC: 100% ZEV sales requirement by 2035
- ACF: Requires that trucks in CA be zero emissions by 2045

LCFS

Makes fuel less polluting and encourages production of cleaner alternatives

How it works:



All together, these actions will help us build a cleaner, healthier California for current and future generations.

Governor Newsom creates new oversight committee to monitor oil companies

CARB

Regulations Implement State Plans

- CARB's Core Long-term Planning Documents
  - State Implementation Plan (SIP) to achieve federal and state air quality goals
  - AB 32 Scoping Plan to achieve state climate targets
    - 2022 Scoping Plan Update builds on existing SIP to ensure alignment with air quality related actions
- ZEV regulations implement SIP and Scoping Plan
  - LCFS is included in analyses for ZEV regulations as part of economic support for ZEV deployment and operation
  - LCFS amendments proposed in 45-day package designed to support recently adopted ZEV regulations

LCFS Supports ZEV Regulations

- LCFS reduces costs of zero emission fuels, contributing to lower total cost of operation for ZEVs
  - Advanced Clean Cars II
  - Advanced Clean Trucks
  - Advanced Clean Fleets
- Other zero emission regulations
  - Shore power, cargo handling, forklifts, and transportation refrigeration units

LCFS Support for ZEV Regulations

Historical	Total credits (MT) Q1 2011 - Q3 2023	Value ($) using avg. 2020-22 credit price
Dispensed electricity (non-residential EVSE)	6,300,000	$1.07B
Dispensed hydrogen	190,000	$3.98M
Sum of dispensed fuel	**6,500,000**	**$1.1B**
Fast Charging Infra capacity credits	234,000	$60M
HRI capacity credits	355,000	$40M
Sum of HRI/FCI*	**590,000**	**$100M (credits even without dispensing fuel)**

Proposed Amendments	Percent of total credits in 2045	Value ($) using avg. 2020-22 credit price
Dispensed electricity	40%	**$3B**
Dispensed hydrogen	5%	**$400M**
Dispensed RNG, renewable diesel and biodiesel	0% (generates deficits)	NA

*HRI/FCI credit totals reflect current utilization. If fully utilized at 2.5% caps, ZEV infrastructure credit revenue could be 4-5x larger

LCFS Support for ZEV Infrastructure Near-term aligned with ZEV Regulations

Proposed Amendments	Max credits (MT) at 2.5% each of deficits	Value ($) using avg. 2020-22 credit price
HD HRI/FCI credits in 2030	2,100,000	**$357M**
HD HRI/FCI credits in 2035	2,600,000	**$441M**

Staff estimates that the proposed HD HRI/FCI provisions could pay for 1.5x the capital costs of **all** the fast chargers and hydrogen stations needed to meet the 2022 Scoping Plan vehicle populations, through 2030 and potentially through 2035

LCFS Long-term support for Alternative Fuels Aligned with ZEV Regulations

Proposed Amendments	Total Credits (net credits/deficits) 2025-2045	Value ($) using avg. 2020-22 credit price
Dispensed electricity	606,000,000	**$103B**
Dispensed hydrogen	34,000,000	**$5.8B**
Dispensed renewable diesel and biodiesel	4,490,000	**$764M**

Fossil fuels (gasoline and diesel) are deficit generators and do not generate credits in the LCFS. **Less than $1 billion estimated for liquid non-fossil drop-in fuels between 2025 and 2045.**

LCFS Supports Transit & Clean Technology & Aligns with Other CARB Regulations

Historical	Total credits (MT)	Value ($) using yearly average credit prices
Transit credits 2022	302,000	**$36M**
Total transit credits (Q1 2011 through Q3 2023)	2,750,000	**$341M**

Historical	Total credits (MT) Q1 2011 through Q3 2023	Value ($) using avg. 2020-22 credit price
Fixed guideways	1,780,000	**$303M**
Shore power for ocean going vessels at berth	1,100,000	**$188M**
Cargo handling equipment	200,000	**$34M**
Forklifts	5,900,000	**$1B**
Transport Refrigeration Units	122,000	**$21M**

Historical LCFS Credit and Retail Fuel Prices Counters Fossil Industry Narrative

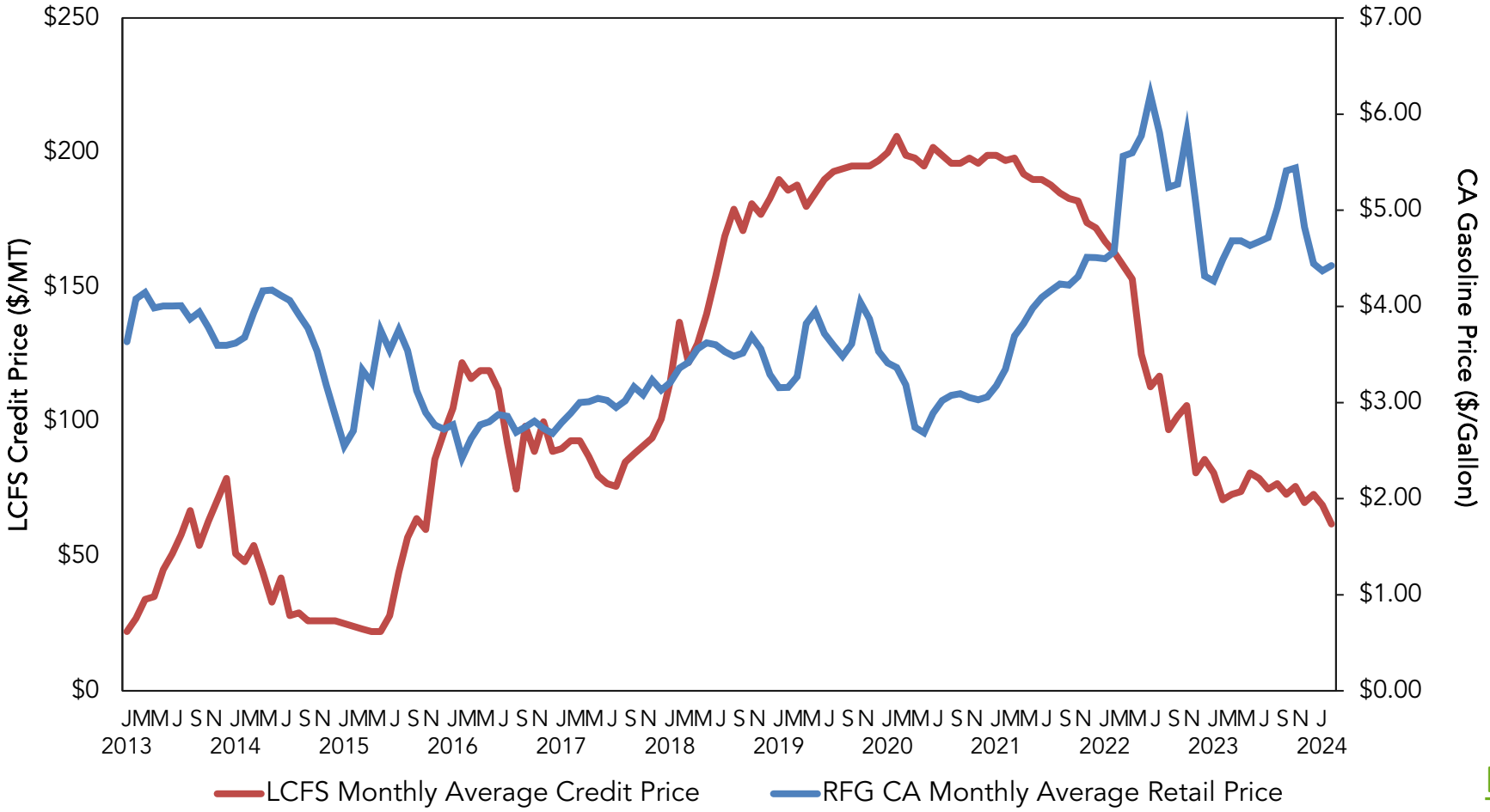


Chart is created by CARB and updates a version provided in the paper referenced below.

"An assessment of observed market prices shows conclusively that the LCFS program price effect at the pump is not a significant driver of retail fuel prices in California."

Executive Summary (bateswhite.com)

LCFS Outcomes

12.6% reduction in the carbon intensity of California's transportation fuels

Over 25 billion gallons of petroleum fuels displaced by low-carbon fuels

60% of fossil diesel displaced by biomass-based diesel in 2023, resulting in PM and NOx benefits

$4 billion annually to support low-carbon investments and $341M cumulative for public transit

Supports many State programs and goals, including cars and trucks going to zero-emission vehicles

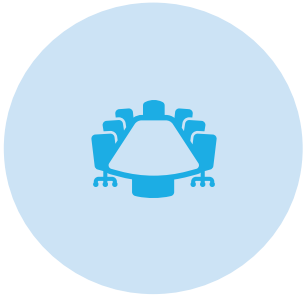
Financial assistance for vehicle purchases at the state and local level

45-day Rulemaking Package Posted

- Initial Statement of Reasons (ISOR) package publicly available on LCFS Rulemaking webpage*
  - Staff Report/ISOR
  - Proposed regulatory text
  - Environmental Impact Analysis
  - Updated Life Cycle Analysis (LCA) modeling tools**
  - Other appendices
- 45-day comment period from Jan 5 – Feb 20, 2024***

* LCFS Rulemaking Webpage: https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024
** LCA modeling tools: https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation
*** LCFS Comment Docket: https://www.arb.ca.gov/lispub/comm/iframe_bcsubform.php?listname=lcfs2024&comm_period=A

Robust Public Process

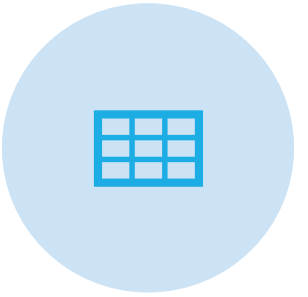


9 PUBLIC WORKSHOPS OVER PAST THREE YEARS

2 COMMUNITY MEETINGS

2 BOARD HEARINGS

OVER 800 COMMENT LETTERS RECEIVED & DOZENS OF MEETINGS WITH STAKEHOLDERS



SUPPLEMENTAL MODELING INFORMATION POSTED PUBLICLY

Supplemental Information Posted

- Staff has posted supplemental information related to the staff report, as well as additional modeling information reflected in this workshop*
- Summary of items posted:
  - Underlying data for figures in ISOR
  - CATS modeling input sheets for all scenarios in ISOR
  - CATS modeling output sheets for all scenarios in ISOR
  - Air quality workbooks for Proposed scenario and EJAC alternative in ISOR
  - CATS modeling input sheets for scenarios represented in 4/10 workshop presentation
  - CATS modeling output sheets for scenarios represented in 4/10 workshop presentation

*Posted on LCFS webpage: https://ww2.arb.ca.gov/resources/documents/supplemental-2023-lcfs-isor-documentation

We Received A Diverse Set of Comments

- Strengthen carbon intensity targets and provide long-term price signals
- Maximize crediting opportunities
- Incentivize development of innovative fuels
- Reduce use of combustion fuels
- Eliminate biomethane from the program
- Continue support for biomethane and prevent stranding assets
- Limit or cap crop-based biofuels
- Expand the use of crop-based biofuel crediting
- Concentrate health and economic benefits in communities burdened by current transportation system
- Provide a mix of low-carbon transportation incentives to communities

Key Concepts for Rulemaking

- Increase the stringency of the program to displace fossil fuels
- Strengthen equity provisions to promote investment in disadvantaged, low-income, and rural communities
- Support electric and hydrogen truck refueling
- Increase the use of alternative jet fuel in the State
- Incentivize more production of clean fuels needed in future, such as low-carbon hydrogen
- Support methane emissions reductions and deploy biomethane for best uses across transportation and other sectors
- Consider guardrails on crop-based fuels

Other Considerations

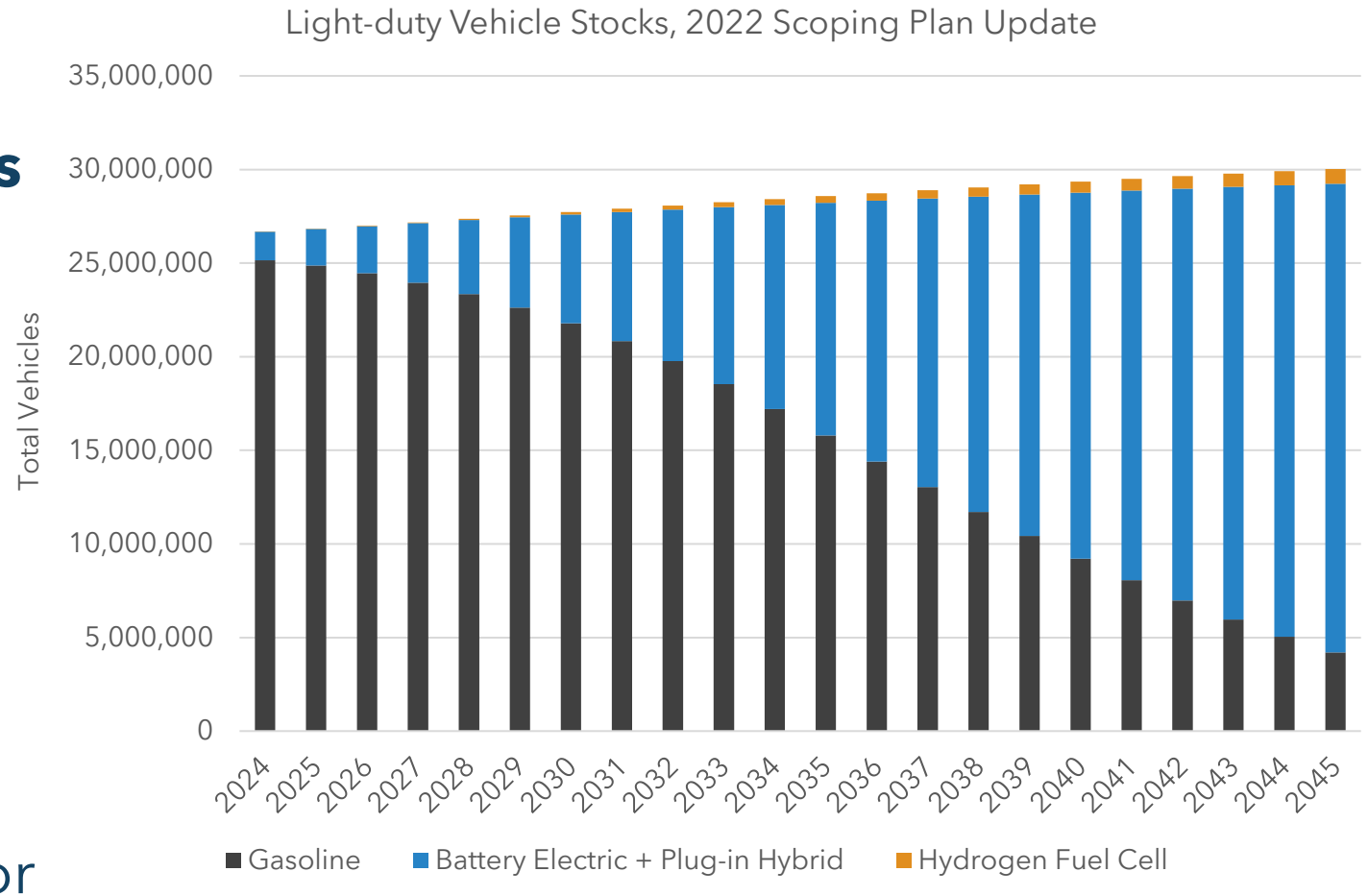
- Needs of light-duty vehicle sector
- Needs of medium/heavy-duty sector
  - Different from LD sector, where VMT reductions can be complimentary
- Federal incentives
- Price-signals for investment
- Near and long-term air quality benefits
- Transportation costs
- Program administration and streamlining

45-day Proposed Regulatory Provisions

- Increase stringency by increasing CI reduction to 30% by 2030 and 90% by 2045 with near-term step-down in stringency
- Implement Automatic Acceleration Mechanism
- Eliminate Exemption for Intrastate Fossil Jet Fuel
- Expand Zero Emission Vehicle Infrastructure Crediting
- Apply Biomethane Deliverability Requirements and Phase Out Avoided Methane Pathways
- Add Crop-Based Biofuels Sustainability Criteria
- Improve Equity Provisions

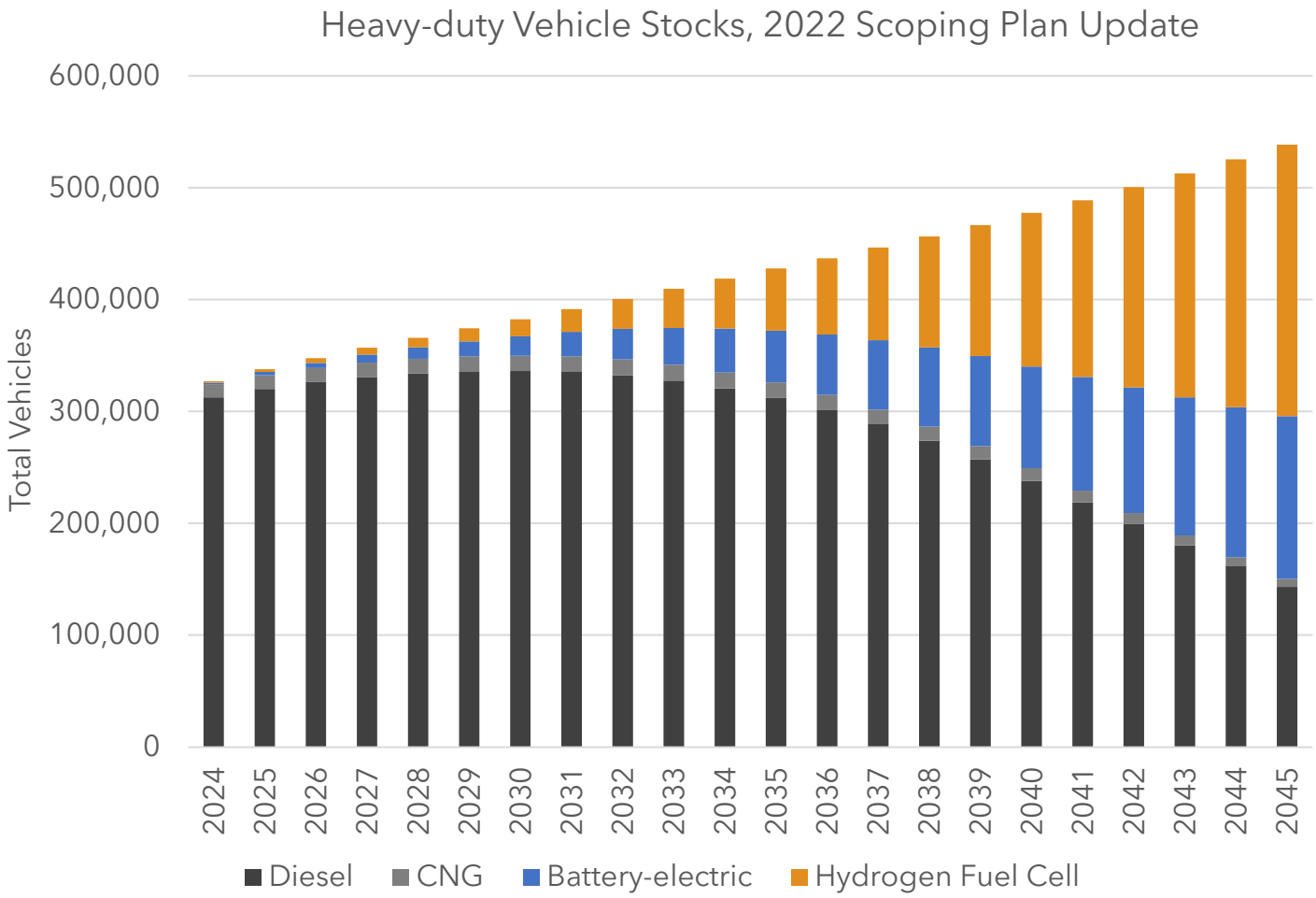
LDVs - Fuel Demand based on Vehicle Population

- Based on implementation of CARB's ACC II regulation, **existing combustion vehicles persist out to 2045**–keeping demand for fossil liquid fuels
- % of combustion vehicles
  - 2025: 93%
  - 2030: 79%
  - 2040: 31%
  - 2045: 14%
- Faster turnover in light-duty sector than with trucking sector

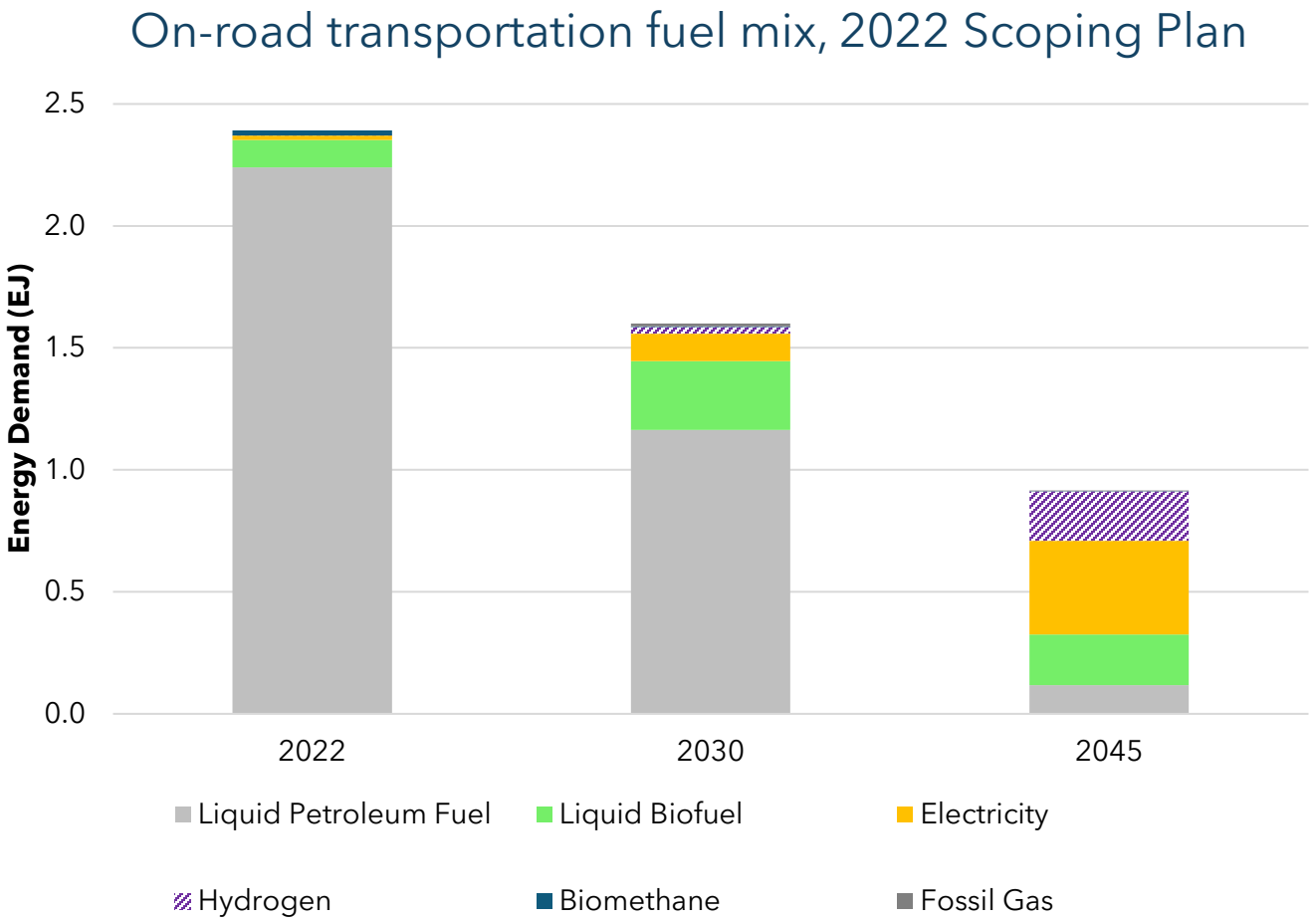


HDVs - Fuel Demand based on Vehicle Population

- Based on implementation of CARB's ACF/ACT regulations:
  - **Existing combustion engines persist for years** due to slow turnover of heavy-duty trucks
  - **Fossil diesel backfills biofuels when biofuel volumes are limited**
- % of combustion vehicles
  - 2025: 98%
  - 2030: 92%
  - 2040: 52%
  - 2045: 28%

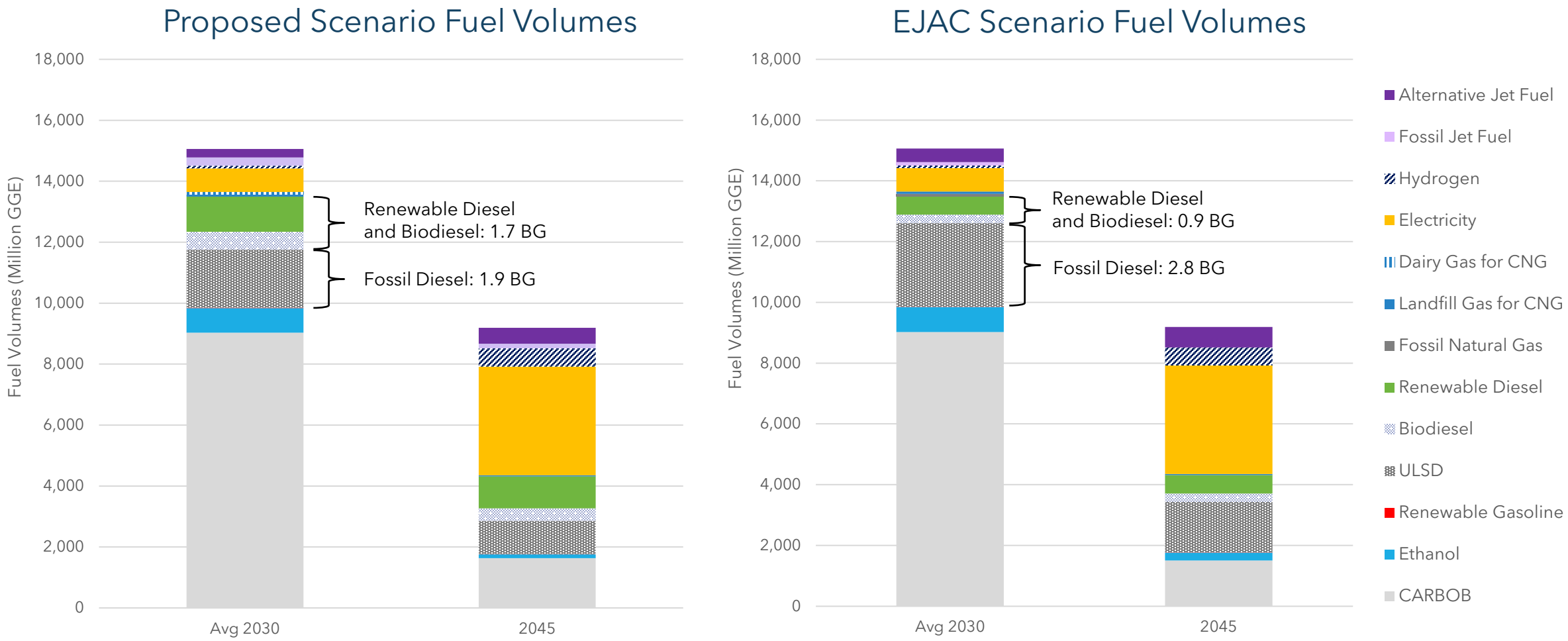


Transportation Fuel Mix, 2022 Scoping Plan

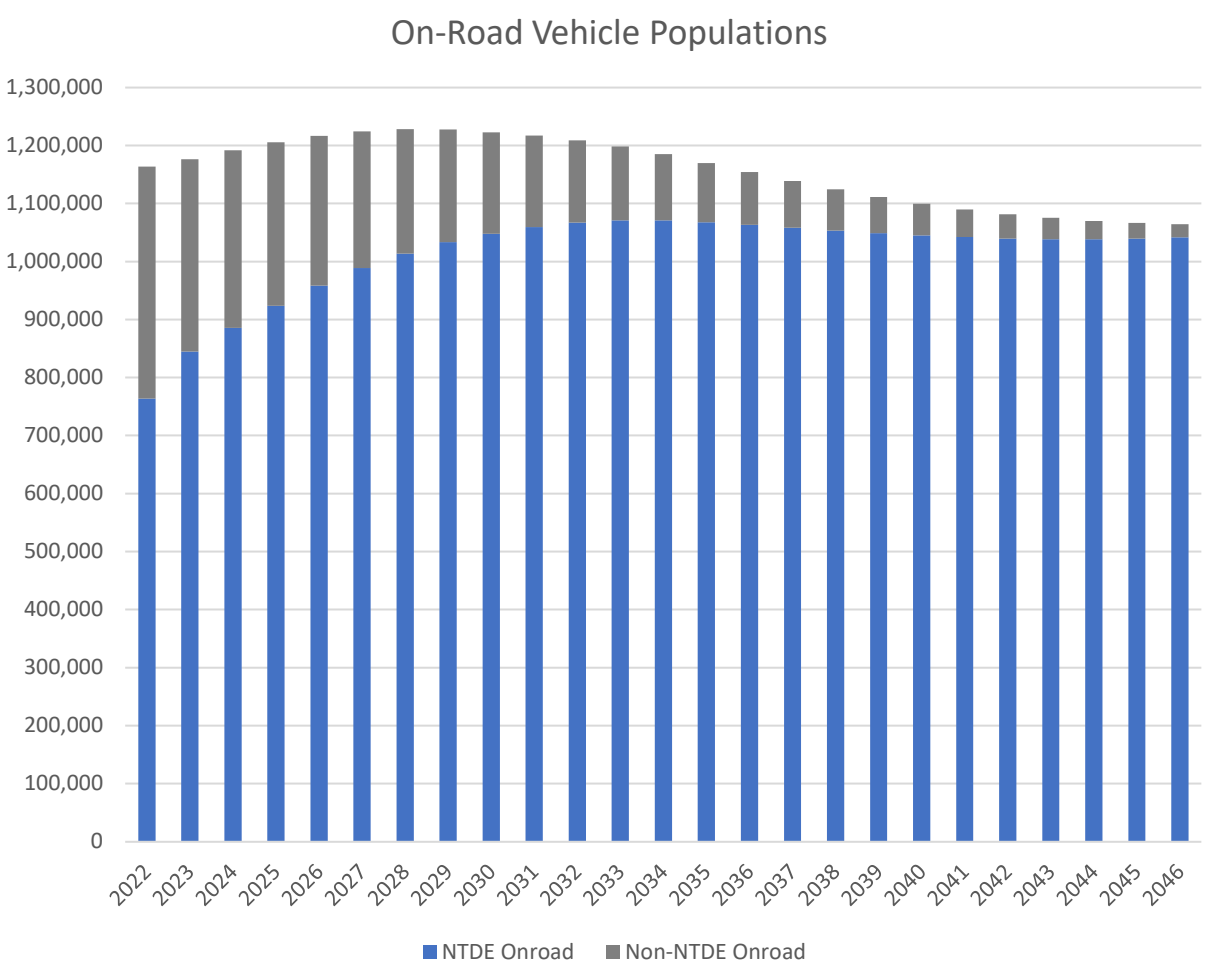


- Fuels transition in 2022 Scoping Plan mirrors the combustion vehicle phaseout in ZEV regulations
- Major transition to electricity and hydrogen, with smaller but persistent role for liquid alternative fuels

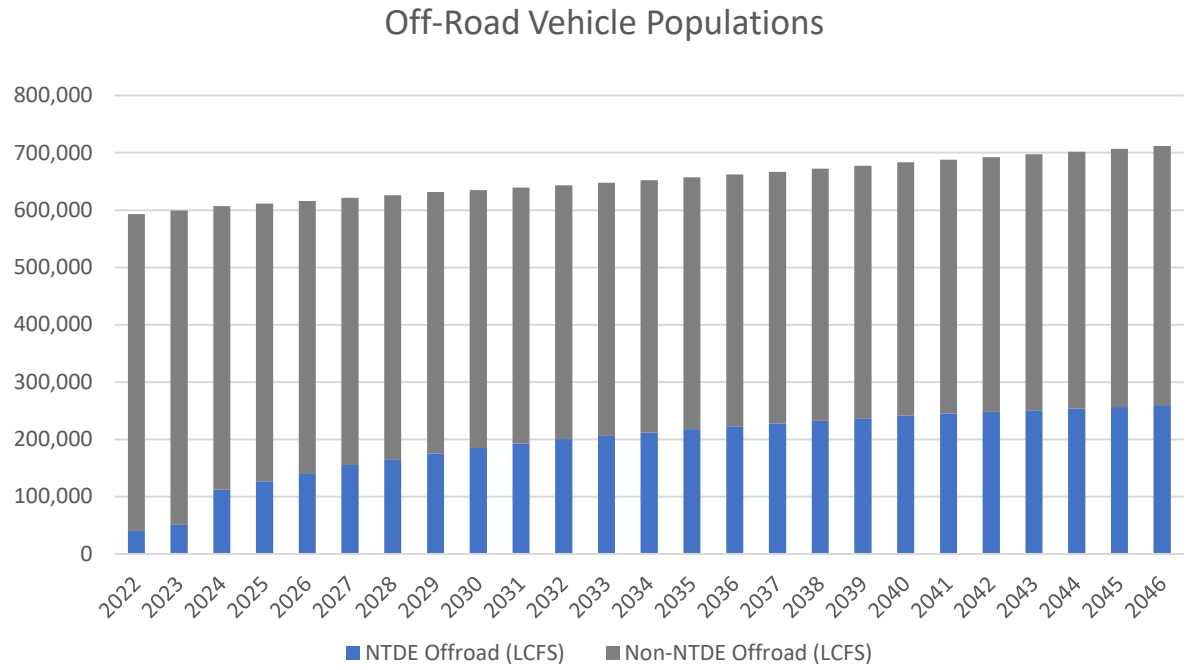
Modeling Comparison: Fuel Volumes



Engine Technology Impacts Emissions



On-road sector transitioning to cleaner new technology diesel engine (NTDE) vehicles faster than off-road sector



Emission Factors Used in AQ Analysis

- Different PM/NOx emission factors for RD and BD between older "legacy" and New-Technology Diesel Engines (NTDE)
- Both fuels reduce PM emissions, which is predominant driver of health analysis
  - Emission Factors based on 2011 Durbin et. al.
  - **2021 LED study confirmed reductions for legacy engines, the study also showed reductions for NTDEs, but were not statistically significant**
- Renewable Diesel
  - Older: NOx decrease
  - NTDE: No additional NOx benefit/impact
- Biodiesel
  - Legacy: NOx increase
  - NTDE: No additional NOx benefit/impact

Table 56: Biodiesel NOx and PM Emissions Relative to Conventional Diesel[118]

		NOx Emissions Change Relative to Conventional Diesel			PM Emissions Change Relative to Conventional Diesel[119]		
Engine Type	Biodiesel Saturation Level	B5	B10	B20	B5	B10	B20
Non- NTDE	Low	1.1%	1.8%	4.0%	-4.7%	-8.9%	-19%
Non- NTDE	High	-0.2%	0.1%	1.5%	-4.7%	-8.9%	-19%
NTDE	Low	0.0%	0.0%	0.0%	-4.7%	-8.9%	-19%
NTDE	High	0.0%	0.0%	0.0%	-4.7%	-8.9%	-19%

Table 57: Renewable Diesel NOx and PM Emissions Relative to Conventional Diesel [120,121,122]

	NOx Emissions Change Relative to Conventional Diesel[123]		PM Emissions Change Relative to Conventional Diesel[124]	
Engine Type	R20	R100	R20	R100
Non-NTDE	-2.9%	-10%	-4.0%	-30%
NTDE	0.0%	0.0%	-4.0%	-30%

2021 LED Study on RD/BD Blends - PM

LEGACY

- RD: Confirmation of PM **decreases** in legacy engines for RD relative to ULSD
- BD: Confirmation of PM **decreases** in legacy engines relative to ULSD

NTDE

- RD/BD: Confirmation of reduced PM emissions relative to ULSD, but not statistically significant

Table ES-5. Average PM emissions, and Percentage Differences and Statistical Comparisons Between the Test Biofuels and CARB Reference Fuel for the Off-Road Legacy Engine

Cycle	Fuel Type	PM Emissions (g/bhp-hr)	% Diff vs. CARB	p-value (t-test)
NRTC	CARB reference diesel	0.061	-	-
	R100	**0.038**	**-38**	**0.00**
	R65/B35	**0.028**	**-53**	**0.00**
	R50/B50	**0.023**	**-63**	**0.00**
D2	CARB reference diesel	0.052	-	-
	R100	**0.038**	**-27**	**0.00**
	R65/B35	**0.025**	**-51**	**0.00**
	R50/B50	**0.022**	**-58**	**0.00**

Statistically significant results are bolded and their percent differences are shown in red.

For the on-road NTDE, PM mass emissions in general were low and near background levels, and averaged less than 0.001 g/bhp-hr for all tests conditions and both cycles. As the PM standard for heavy-duty on-road engines is 0.01 g/bhp-hr, the PM emissions observed are for the most part at least 20-fold lower than the PM standard. The PM emissions for the different fuels generally did not show statistically significant differences, with the exception of the R50/B50, which had emissions that were lower than those for the CARB reference fuel at a marginally statistically significant level over the FTP cycle.

2021 LED Study on RD/BD Blends - NOx

LEGACY

- RD: Confirmation of NOx **decreases** in legacy engines relative to ULSD
- BD: Confirmation of NOx **increases** in legacy engines relative to ULSD

NTDE

- RD: No statistically significant difference between RD or ULSD for NOx in NTDE
- BD: NOx **increases** in NTDE relative to ULSD
  - SRIA assumes equivalency
  - Staff are conducting additional testing to collect more data

Table ES-2. NOx Emissions, and Percentage Differences and Statistical Comparisons Between Biofuels and the CARB Reference Fuel for the Off-Road Legacy Engine

Cycle	Fuel Type	Ave. NOx Emissions (g/bhp-hr)	% Diff vs. CARB	p-value (t-test)
NRTC	CARB reference fuel	2.09	-	-
	R100	**1.98**	**-5.4**	**0.00**
	R65/B35	2.07	-1.2	0.18
	R50/B50	**2.13**	**1.8**	**0.05**
D2	CARB reference fuel	2.01	-	-
	R100	**1.91**	**-4.9**	**0.00**
	R65/B35	2.01	0.0	0.97
	R50/B50	**2.09**	**4.2**	**0.02**

Statistically significant results are bolded and their percent differences are in red text.

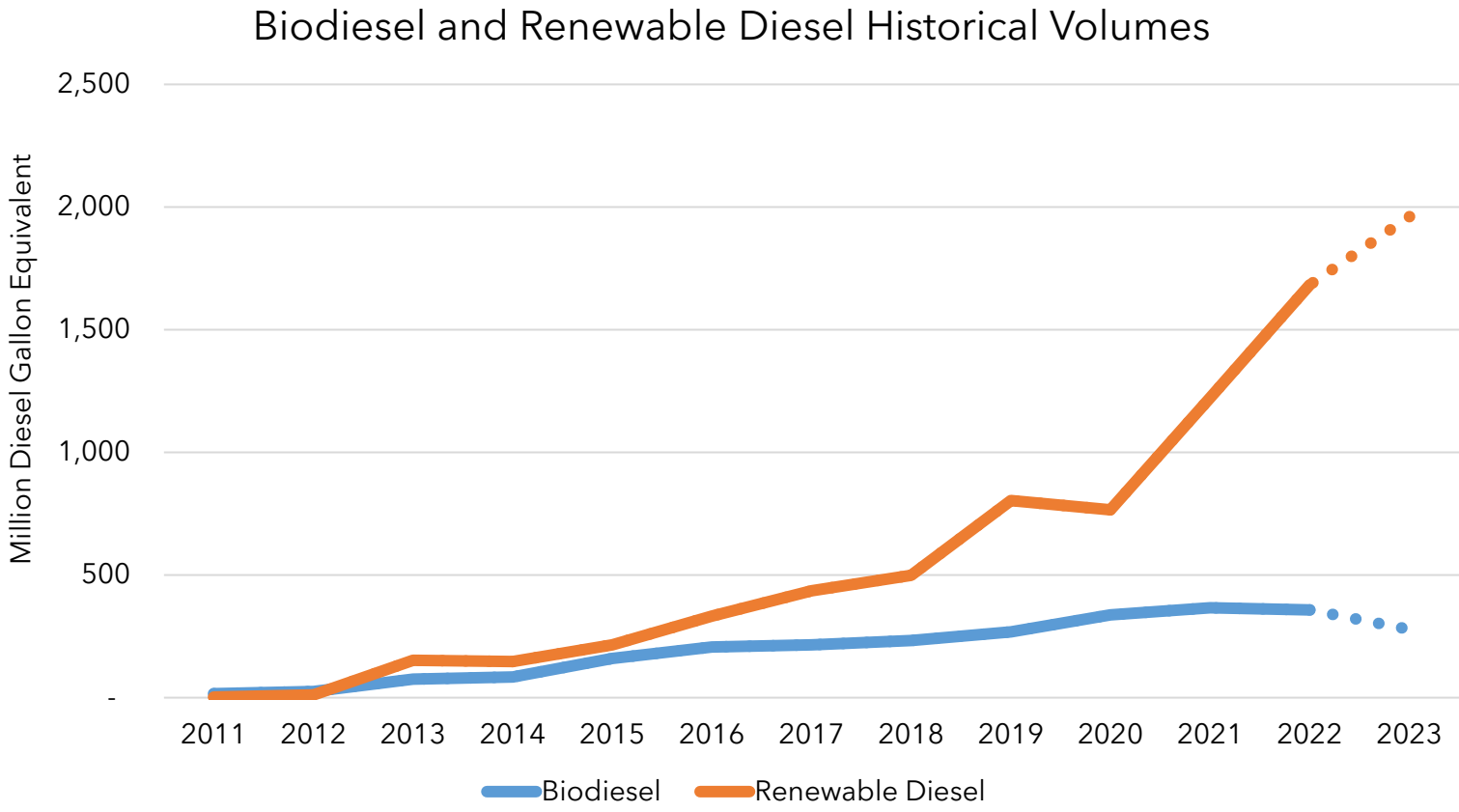
Table ES-3. NOx Emissions, and Percentage Differences and Statistical Comparisons Between Biofuels and the CARB Reference Fuel for the On-Road NTDE

Cycle	Fuel Type	NOx Emissions (g/bhp-hr)	% Diff vs. CARB	p-value (t-test)
FTP	CARB reference fuel	0.11	-	-
	R100	0.12	4.8	0.34
	R65/B35	**0.16**	**46.6**	**0.00**
	R50/B50	**0.17**	**49.5**	**0.00**
RMC	CARB reference fuel	0.13	-	-
	R100	0.14	2.3	0.19
	R65/B35	**0.15**	**14.2**	**0.00**
	R50/B50	**0.15**	**15.4**	**0.00**

Statistically significant results are bolded and their percent differences are shown in red.

Biodiesel and Renewable Diesel Volumes

- Biodiesel and renewable diesel are distinctly different fuels
- Biodiesel volumes have not grown significantly for many years and declined in Q1-Q3 2023
- Renewable diesel makes up almost all of the growth in diesel alternatives



*Note: Q4 2023 volumes estimated using average of Q1-Q3 2023 reported data

45-Day Proposal

- 30% CI reduction by 2030, 90% CI reduction by 2045
- Fossil jet deficits
- Expand Zero Emission Vehicle Infrastructure Crediting
- Biomethane deliverability and pathways phase out
- Sustainability guardrails

GHGs	Health	Costs	Balances need for investment signal with need for compliance
558 MMT CO2e reduction	$5B decrease in costs in 2045	$32B net cost increase	

Criteria Pollutant Emissions of Fuels

- PM and associated health benefits of RD and BD use, relative to ULSD.
- NOx emissions depend on fuels and engine types.
  - RD shows NOx reductions, particularly in legacy engines.
  - BD has potential to increase NOx emissions, testing shows emissions depend on fuel blend and engine.
- CARB adopted Alternative Diesel Fuel (ADF) Regulation to ensure NOx equivalency.
  - ADF Regulation requires blends above B5 be mitigated.
- 2021 LED study used higher biodiesel blends than may be used in CA.
- CARB has commissioned further testing on BD and RD.

EJAC (EJ) Scenario

- 30% CI reduction by 2030, 90% CI reduction by 2045
- Fossil jet deficits
- Expand Zero Emission Vehicle Infrastructure Crediting
- End biomethane crediting
- Apply limits on biomass-based diesel
- No direct air capture credits

GHGs	Health	Costs	Needs more credits for compliance than available
386 MMT CO2e increase	$2B increase in costs in 2045	$85B net cost increase	

Other Options Staff Also Evaluated

- Less Stringent Near-Term CI Targets
  - 28% by 2030 with 3% step down in 2025
  - Phasing down biomethane crediting
  - Limits on crop-based diesel

Greater need for fossil diesel, more GHG emissions, higher costs after 2030

- More Stringent CI Targets
  - 35% by 2030 with 5% step down in 2025
  - No additional crediting constraints

Highest cost scenario

Questions Raised by External Modeling

- Areas that warrant additional staff evaluation:
  - Availability of non-biofuel credit generating opportunities, in particular prior to 2030.
  - Assumptions on future RD volumes and feedstock types/quantities to meet production needs
  - Effect of Auto Acceleration Mechanism on credit/deficit supply
  - Impact of fuel/feedstock combos switching from credit to deficit generating as CI benchmarks continue to decline and program becomes more stringent
  - Potential other alternative fuels to reduce fossil fuel use in legacy combustion vehicles

Updated Analysis for April Workshop

- Step-downs
- BD/RD tailpipe emission factor (N_2O and CH_4)
- Energy demand from PHEVs
- Updated MDV energy demand to reflect ACF's 15-day revision to vehicle stocks
- Biomethane representation
- Auto-adjustment mechanism
- Renewable diesel volumes
- Feedstock supply assumptions

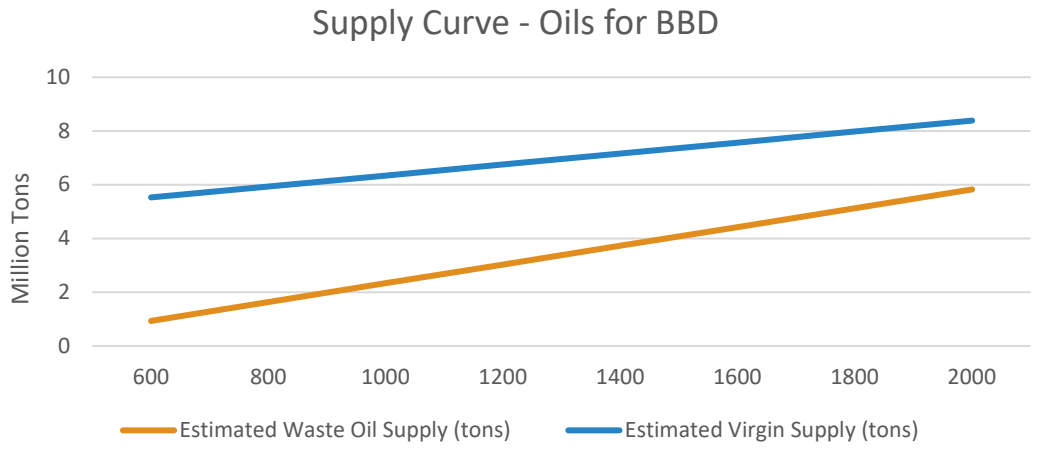
Biofuels availability assumptions and emission factor updates

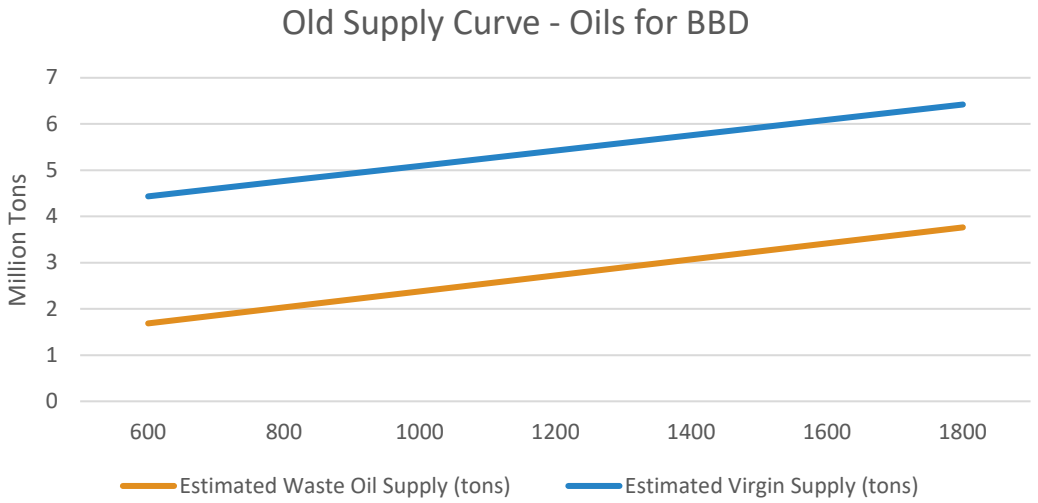
- Received feedback that staff proposal underestimates renewable diesel supply
- Updates to supply assumptions:
  - Refined supply curves for renewable diesel from virgin oils and waste oils
- CA-GREET4.0 updated to apply tailpipe emission factor for fossil diesel to biodiesel and renewable diesel carbon intensities

Baseline CI for ULSD

- In the ISOR amendment proposal package, staff incorporated a new baseline 2010 CI score for ULSD to reflect the updated value from CA-GREET4.0
- The change reflects increased tailpipe CH_4 and N_2O emissions factors for diesel combustion
- Stakeholders raised concerns that increasing the ULSD baseline 2010 value would result in significant additional crediting for diesel fuel replacements
- An adjustment in the RD/BD CI scores to reflect the same change to both is included in the modeling shown today
- Updating CA-GREET 4.0 to include the additional tailpipe emissions for RD/BD as well as ULSD will reduce the amount of additional crediting introduced from the increased baseline.

CATS Supply vs. Current Trends

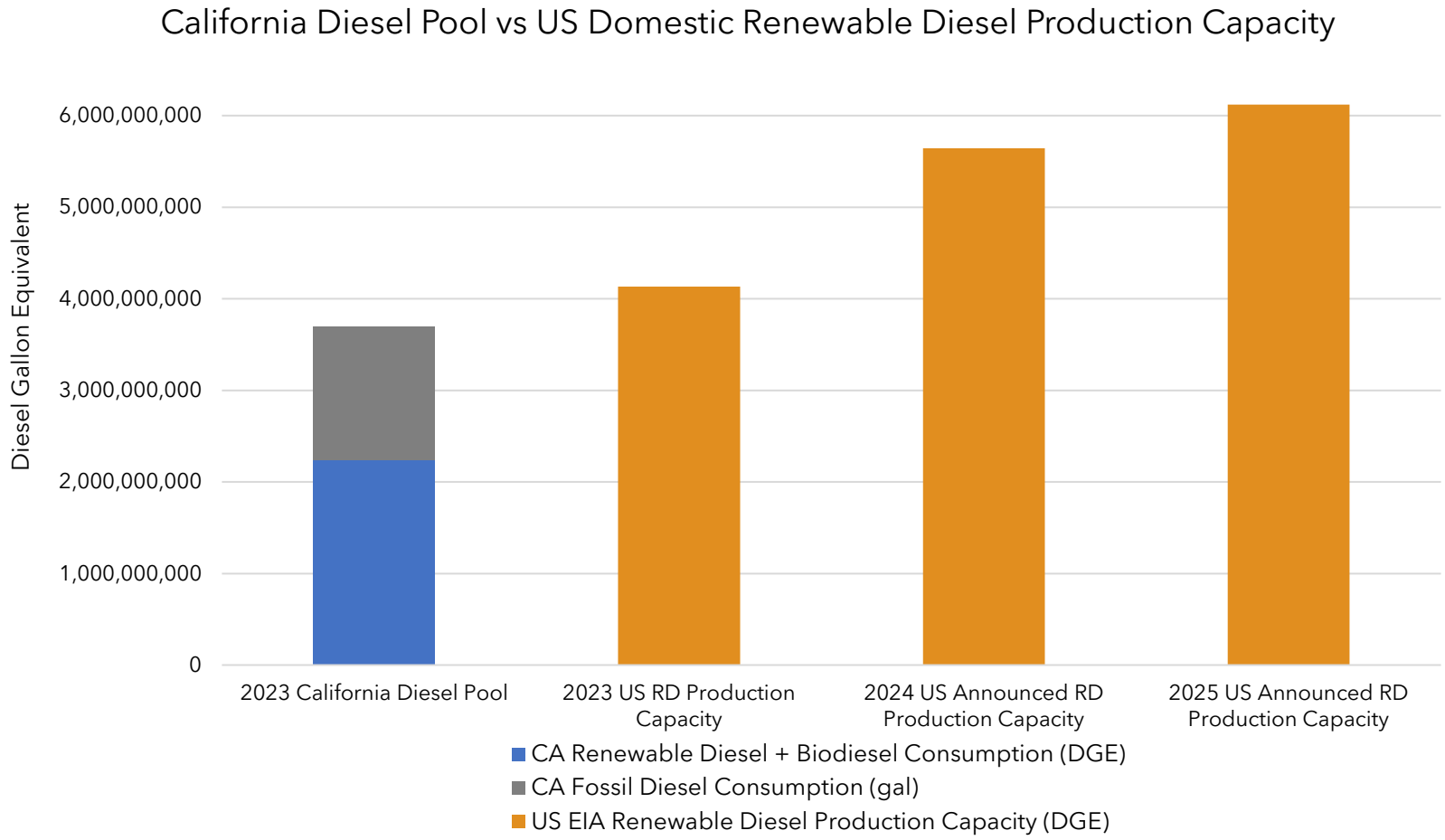




- Total UCO available at $2000 – 5.8 M tons
- Total Virgin Oil available at $2000 – 8.4 M tons
- Improvements Shown
  - Tied inputs to trendline values, rather than single month data
  - Matched time period of analysis for waste oils to that of virgin oils

Diesel and Jet Fuel Pools – U.S. Production

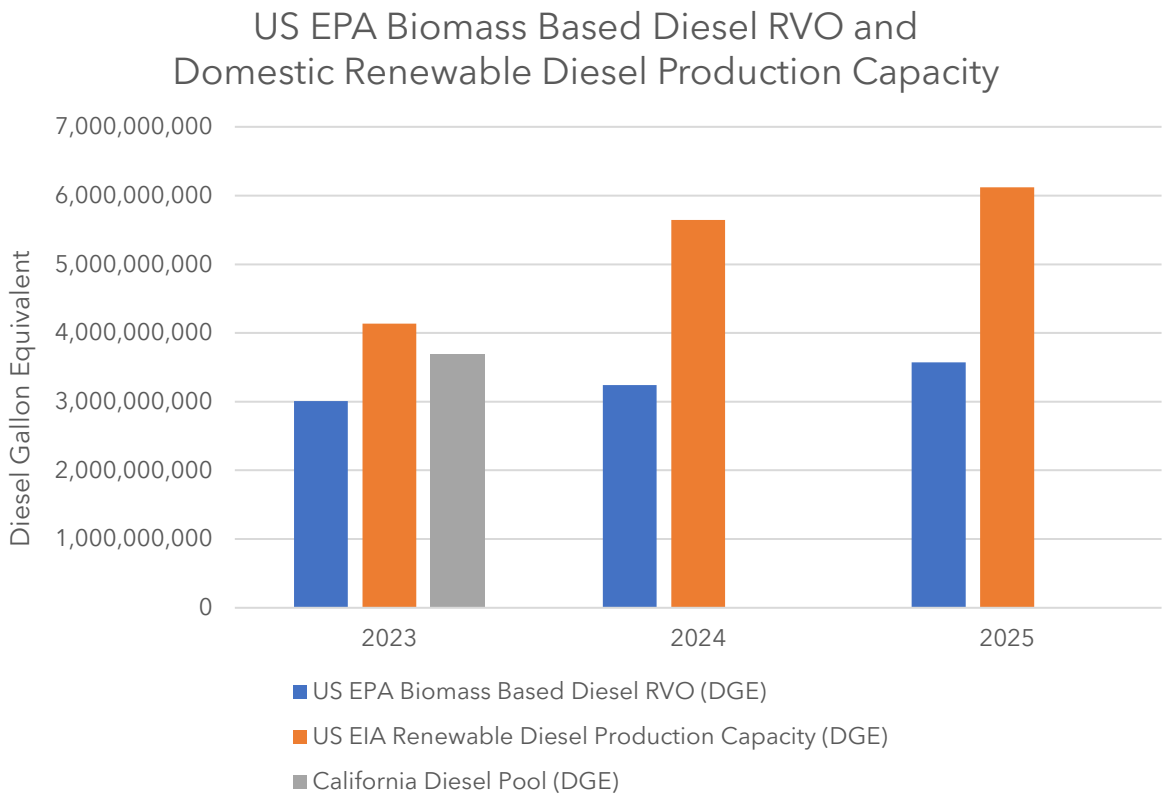
- Liquid biofuels have not yet saturated the market
  - Diesel fuel pool: 60% biofuels in Q3 2023
  - Jet fuel pool: 3% biofuels (intrastate only) from most recent year of data
- Significant increases in domestic production capacity may bring more volumes to California



Sources:
LCFS Data from Quarterly Data Summary Spreadsheet
Domestic capacity data from EIA:
https://www.eia.gov/todayinenergy/detail.php?id=55399

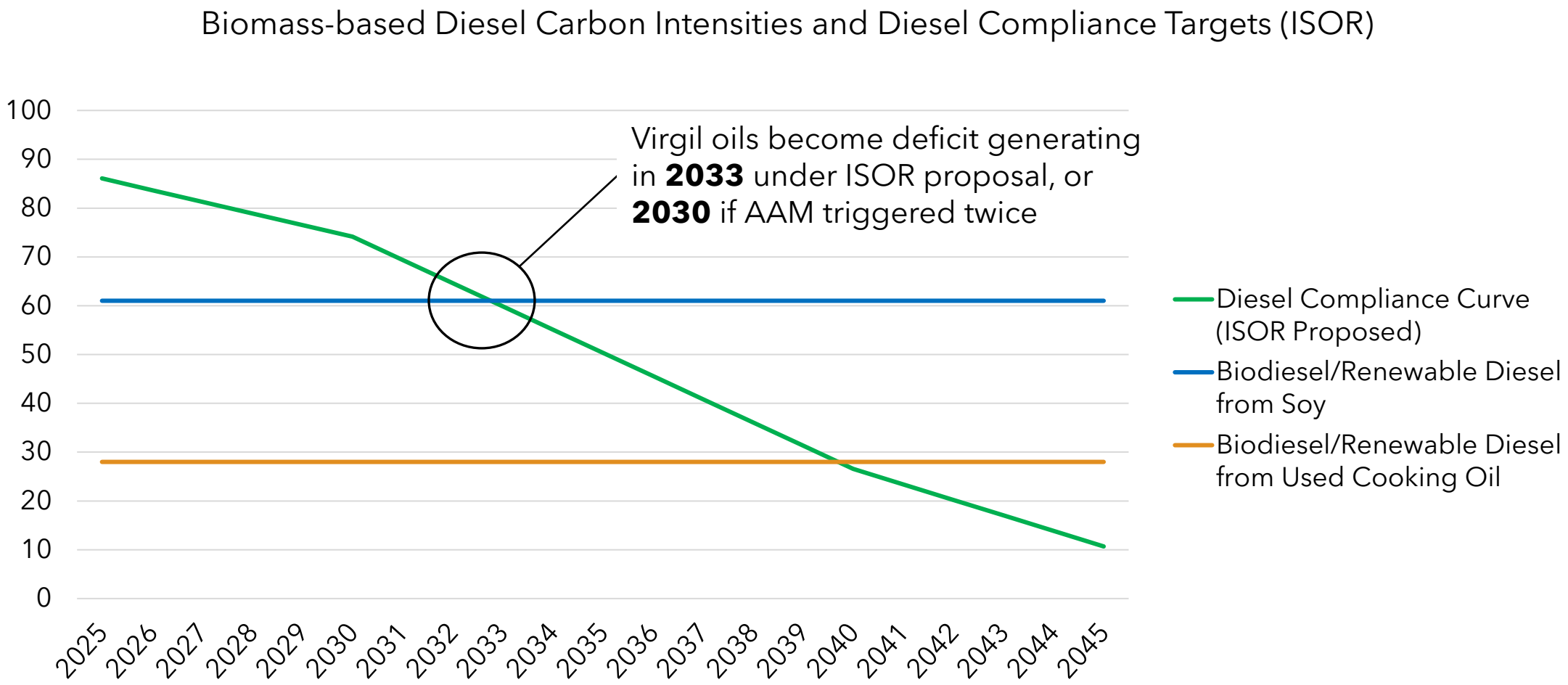
Future Renewable Diesel Supply

- Domestic renewable diesel capacity exceeds California diesel pool with significant announced future capacity
- US EPA RVO for 2023-2025 is significantly lower than the announced domestic capacity
- High crude prices can compensate in part for lower RFS support, but are variable
- Creates uncertainty for modeling, given history of supply adjusting toward RVO for other fuels



Sources:
EIA, Feb 2, 2023. https://www.eia.gov/todayinenergy/detail.php?id=55399
EPA, June 21, 2023. https://www.epa.gov/renewable-fuel-standard-program/final-renewable-fuels-standards-rule-2023-2024-and-2025

Credit Generation for Virgin Oil Feedstocks Naturally Phases Out



Scenarios Analyzed for Workshop

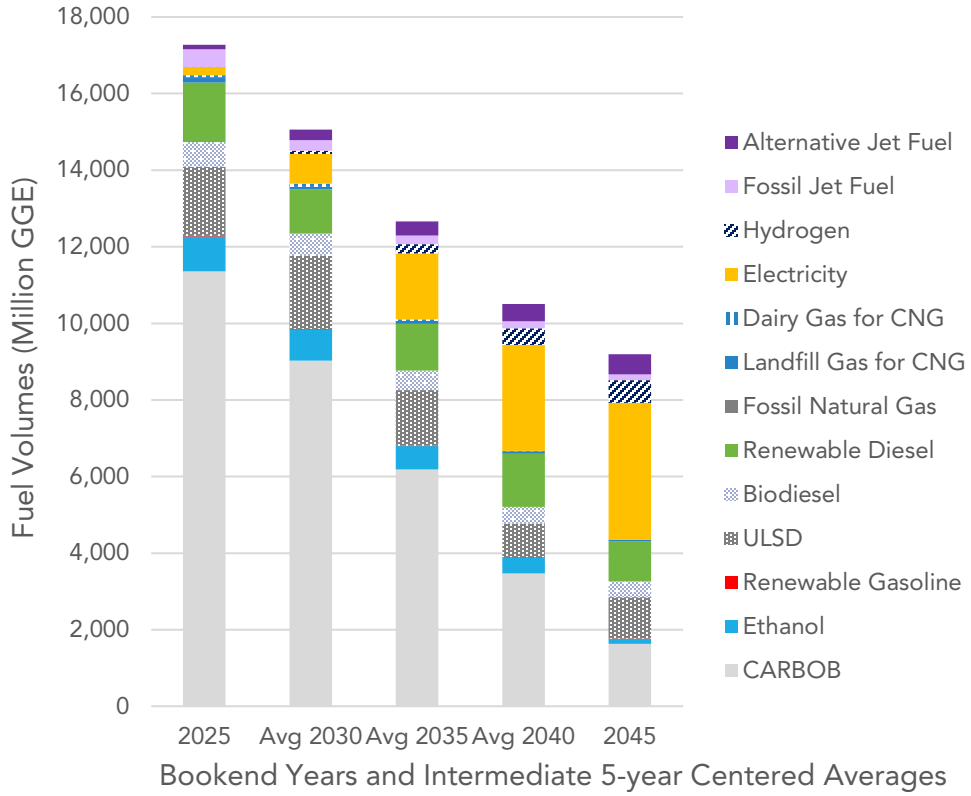
- 5% step-down, 7% step-down, and 9% step-down in 2025
  - All include 30% CI reduction by 2030 and 90% CI reduction by 2045

- 5% step-down in 2025 with Auto-Acceleration Mechanism triggered twice
  - Results in 39% CI reduction by 2030 and 90% CI reduction **two years earlier** in 2043

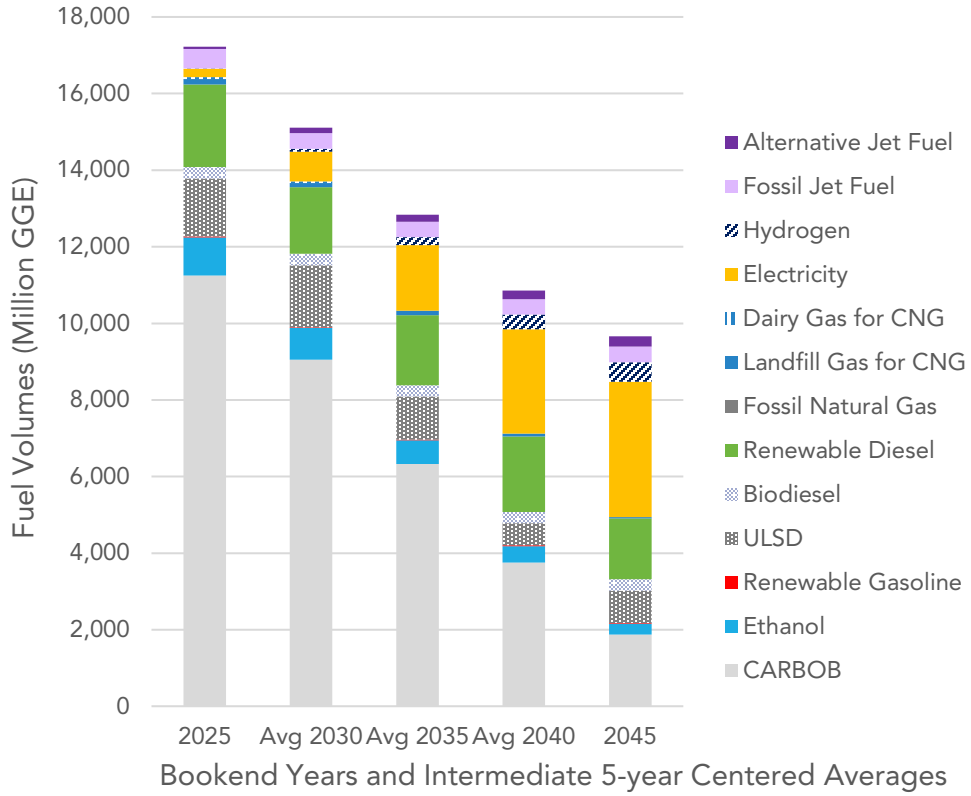
- All scenarios reflect updated modeling inputs

Updates to 45-Day Proposal

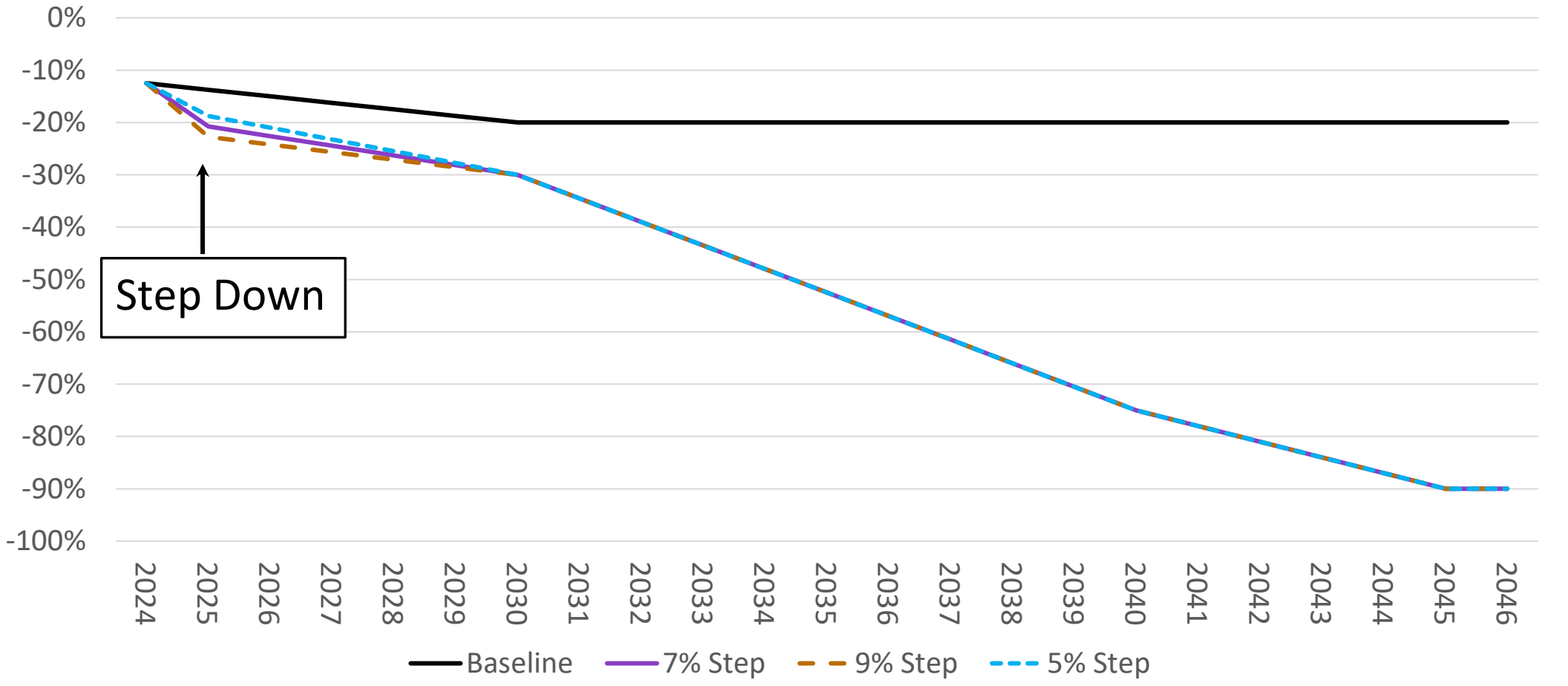
ISOR Proposed
5% Step Down and 30% in 2030



April 2024 Workshop
5% Step Down and 30% in 2030

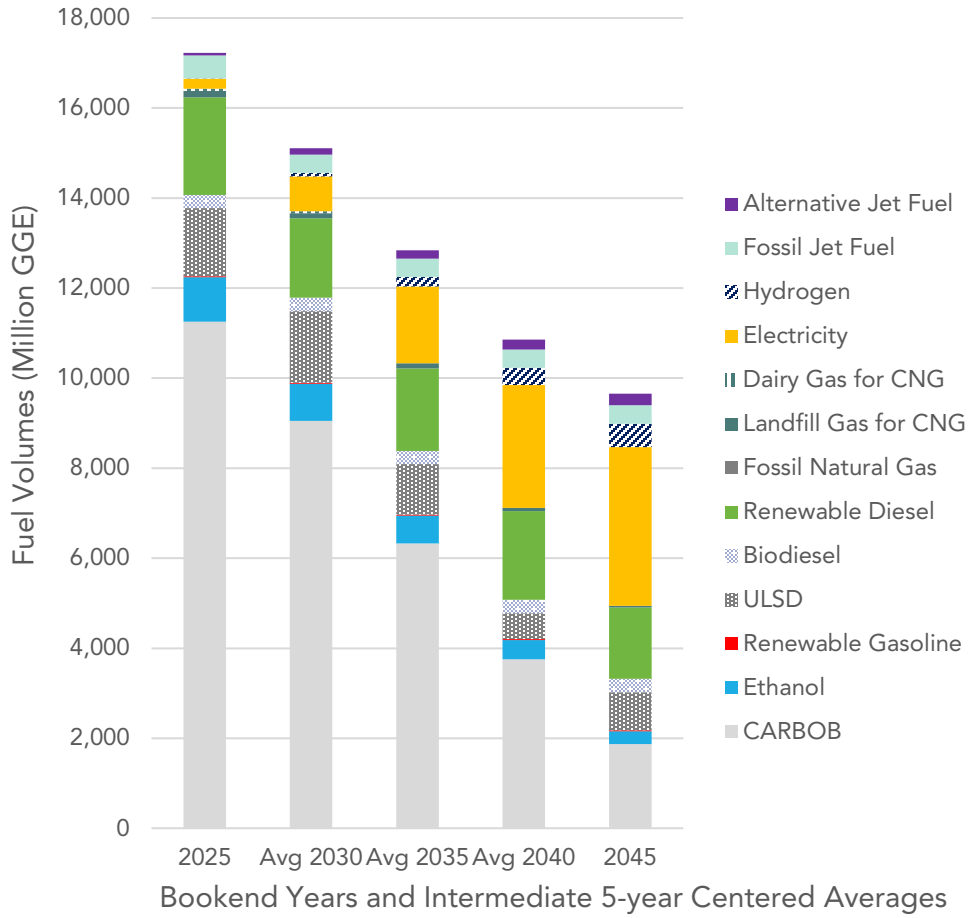


Increased Step-downs



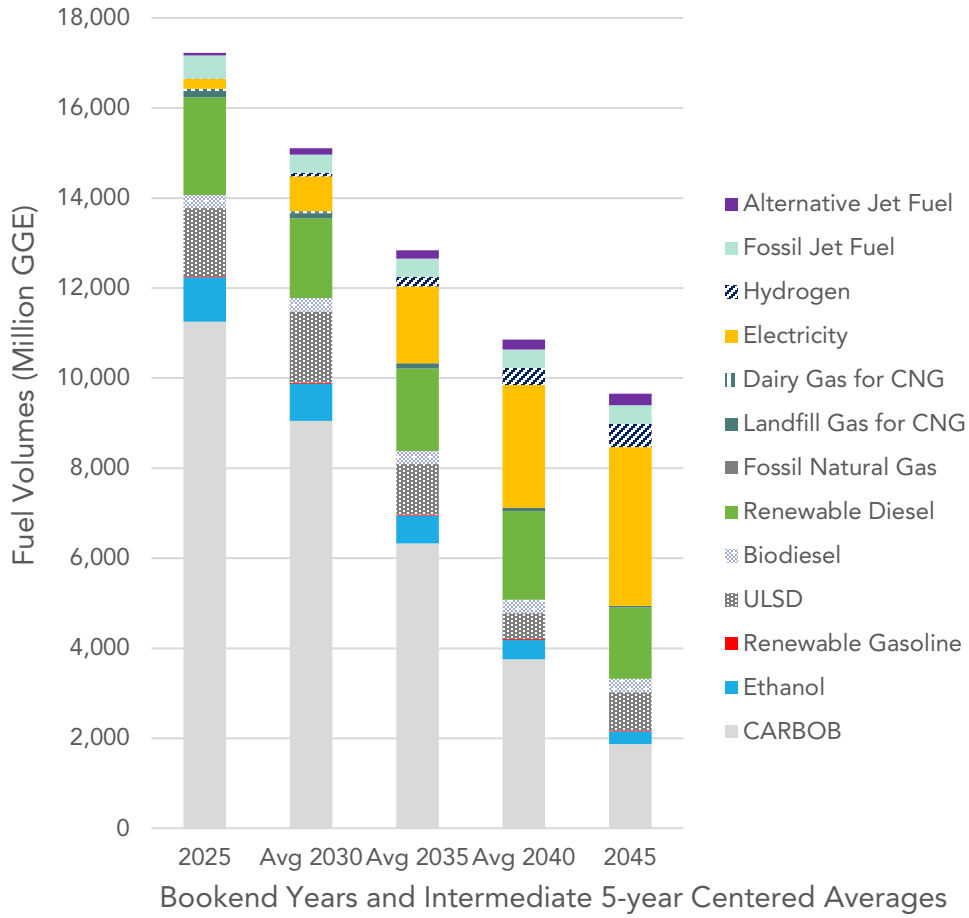
7% Step Down and 30% by 2030

- Bank Drawdown - 17 million between 2025 and 2046
- Total Electricity - 1,367,482 GWh
- Total Hydrogen - 5,367 MM kg
- Total Biofuel Volume – 75,118 MM GGE
- Total Fossil Volume – 212,082 MM GGE



9% Step Down and 30% by 2030

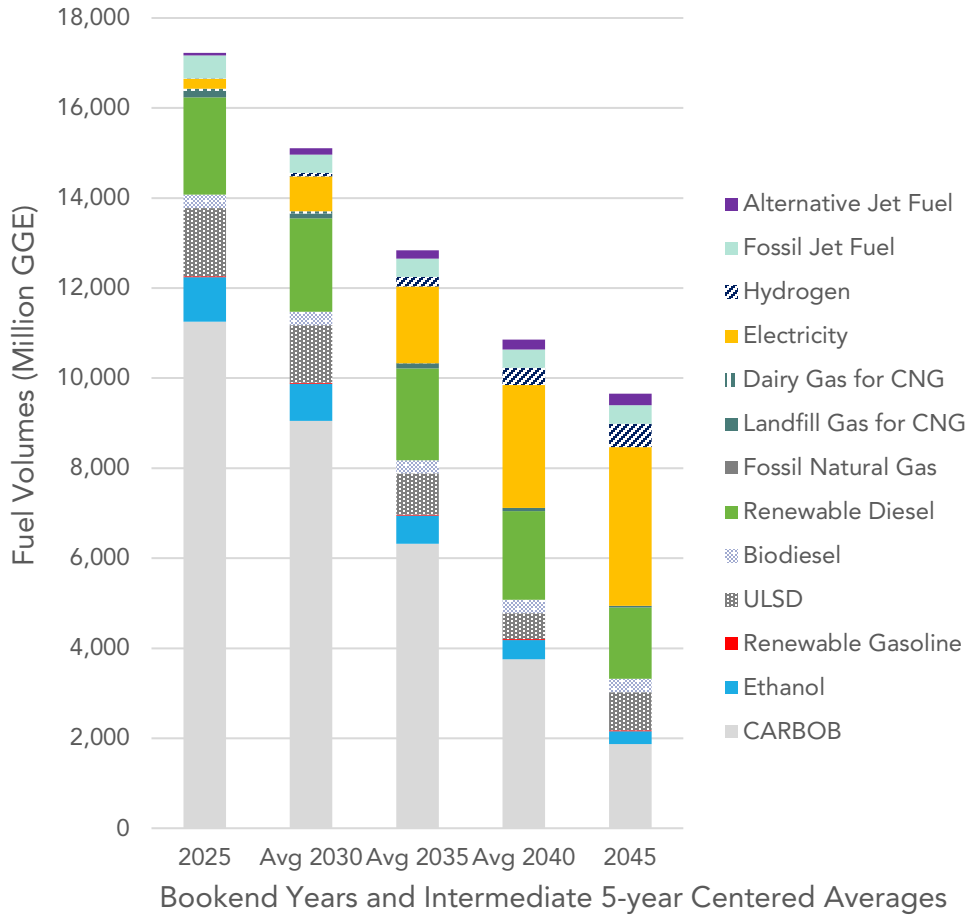
- Bank Drawdown - 27 million between 2025 and 2046
- Total Electricity - 1,367,482 GWh
- Total Hydrogen - 5,367 MM kg
- Total Biofuel Volume – 75,143 MM GGE
- Total Fossil Volume – 212,057 MM GGE



Illustrative Scenario - 5% Step Down with Two Automatic Accelerations

- Modeling doesn't directly simulate situations that would trigger AAM
- Staff "forced" modeling of two AAM triggering to illustrate impact by manually advancing CI benchmarks in 2028 and 2030.

- Minimum Bank Drawdown – 171 million credits
- Total Electricity - 1,367,482 GWh
- Total Hydrogen - 5,367 MM kg
- Total Biofuel Volume – 80,764 MM gallons
- Total Fossil Volume – 196,653 MM gallons



Modeling Comparison

	5% Step Down 30% in 2030*	7% Step Down 30% in 2030	9% Step Down 30% in 2030	5% Step Down Double AAM
Minimum Bank Drawdown**	3 million credits	17 million credits	27 million credits	171 million credits
Total Electricity	1,367,482 GWh	1,367,482 GWh	1,367,482 GWh	1,367,482 GWh
Total Hydrogen	5,367 MM kg	5,367 MM kg	5,367 MM kg	5,367 MM kg
Total Biofuel Volume	74,178 MM GGE	75,118 MM GGE	75,143 MM GGE	77,505 MM GGE
Total Fossil Volume	213,021 MM GGE	212,082 MM GGE	212,057 MM GGE	209,695 MM GGE

*Using updated input assumptions
** Bank Drawdown is cumulative between 2024-2046

Additional Analysis - Discussion

- Impacts of Different Step-Downs
  - 7% step-down increases biofuel availability relative to 5% step-down.
  - Modeling shows much smaller increases in biofuel volumes when moving from a 7% step-down to a 9% step-down
  - Both step-downs reduce credit generation per-gallon of biofuels
- Impacts of Automatic Acceleration Mechanism
  - Significant change in biofuel volumes relative to other options
  - Potential for significant changes in bank drawdown
  - Biofuels become deficit-generating sooner
- All options increase the potential for bank drawdown
  - Creates additional risk of credit shortages, particularly when CI reduction stringency increases in later years

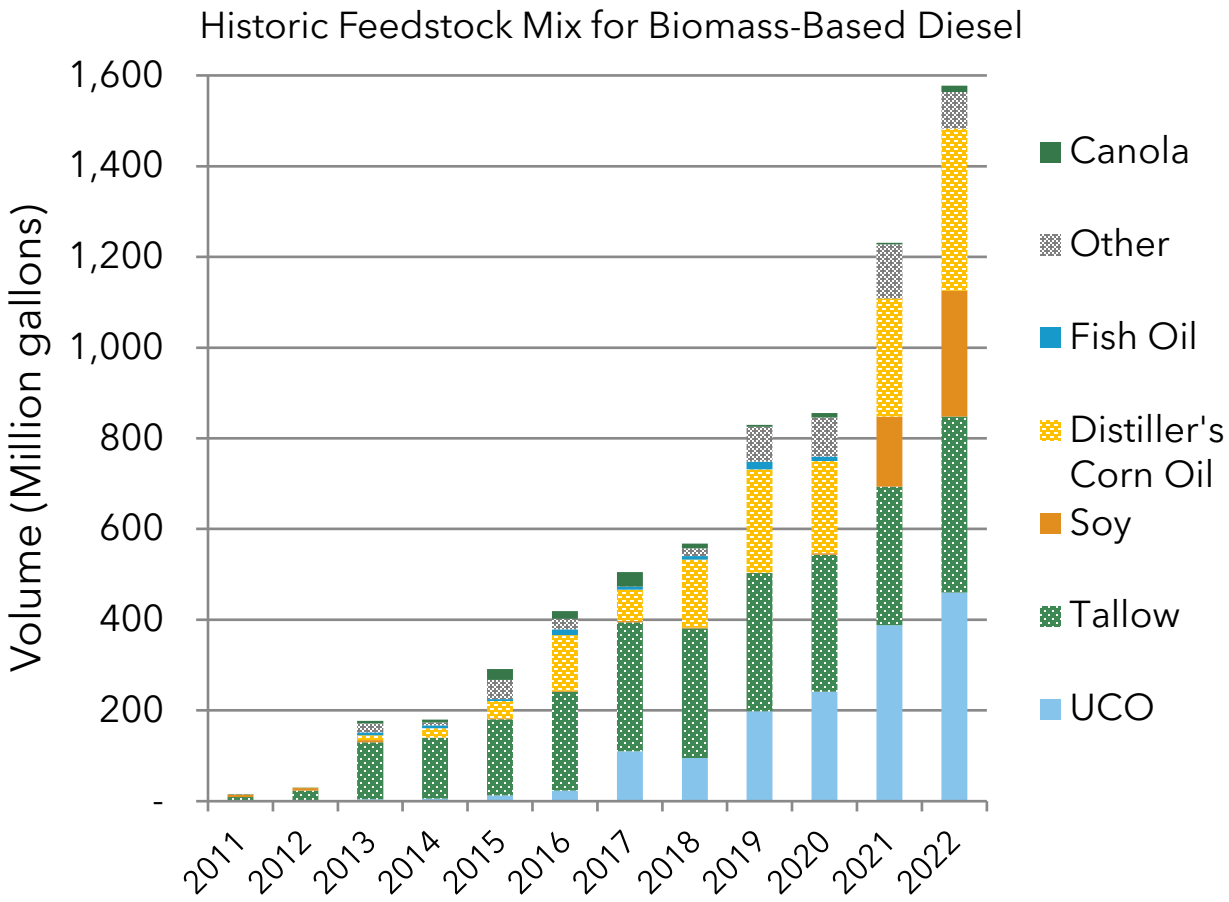
Feedback Requested

- Short-term vs long-term market conditions – how should staff approach the increased stringency need? Is it a one-time near-term need or do stakeholders anticipate rapid and sustained decarbonization progress through the next 10+ years?
- Which approach can provide a smooth/sustained market signal to support deeper decarbonization in the 2030s?
- Should staff consider any changes to the trigger conditions for the AAM?

Crop-Based Biofuels Sustainability

Crop Sustainability

- Biofuel production must not come at the expense of deforestation or food production.
- CARB staff solicited feedback on crop-based biofuels sustainability concerns during past workshops
- Staff directed to investigate guardrails at the Sept 28, 2023 informational board hearing
- Staff 45-Day Proposal:
  - Require independent feedstock certification by a certification body approved by the Executive Officer
  - Built in timeline to develop those standards and approval processes by third party certifiers
  - Remove palm-derived fuels from eligibility for credit generation
- Also considering other changes

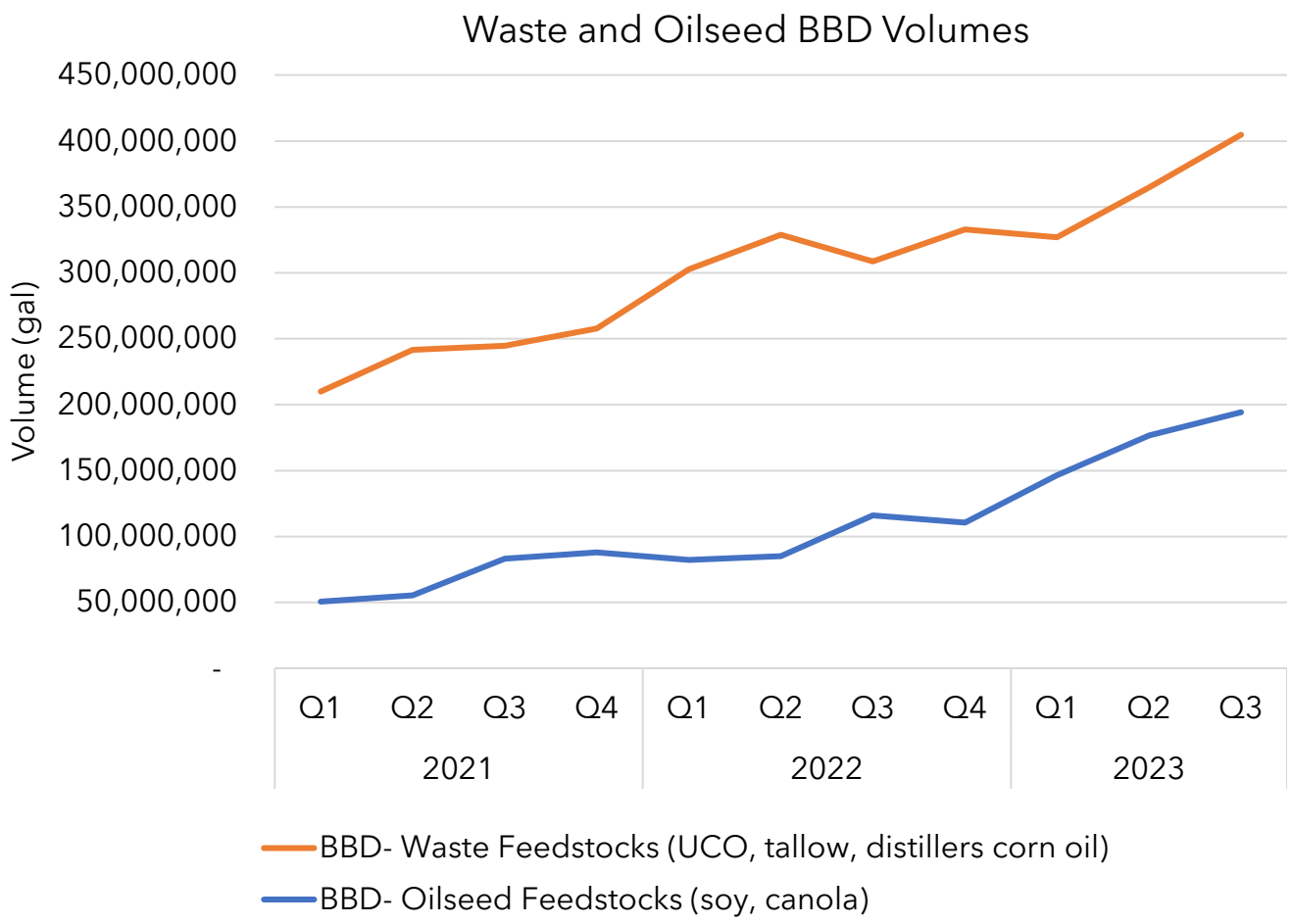


Topics for Discussion

- How has crop-based oil seed demand and production changed as biomass-based diesel (BBD) volumes increased?
- Does evidence show that BBD production is increasing crop-based oilseed demand and/or prices?
- Is the increase in BBD production resulting in deforestation and/or food system impacts?
- What guardrails should be included in the LCFS program?
- Given existing combustion engines persist, what liquid fuel options exist to meet demand and support GHG and air quality needs?
- Should E15 be considered to help reduce retail gasoline costs?

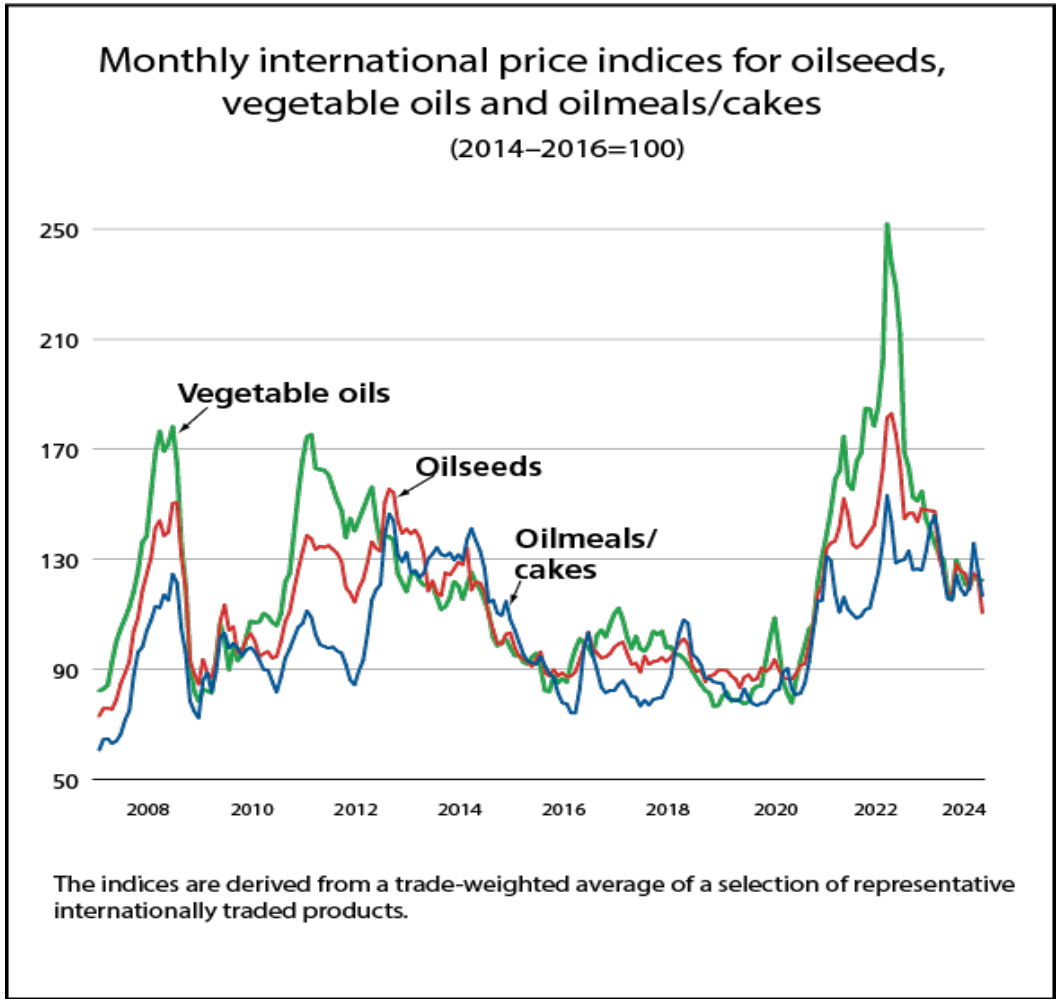
Recent Feedstock Trends in BBD

- Both waste-based and oilseed feedstocks have increased
- Rapid rise in 2021, mainly from increased soy usage
- From 2022-2023, waste-based feedstocks have risen more rapidly than oilseed feedstocks



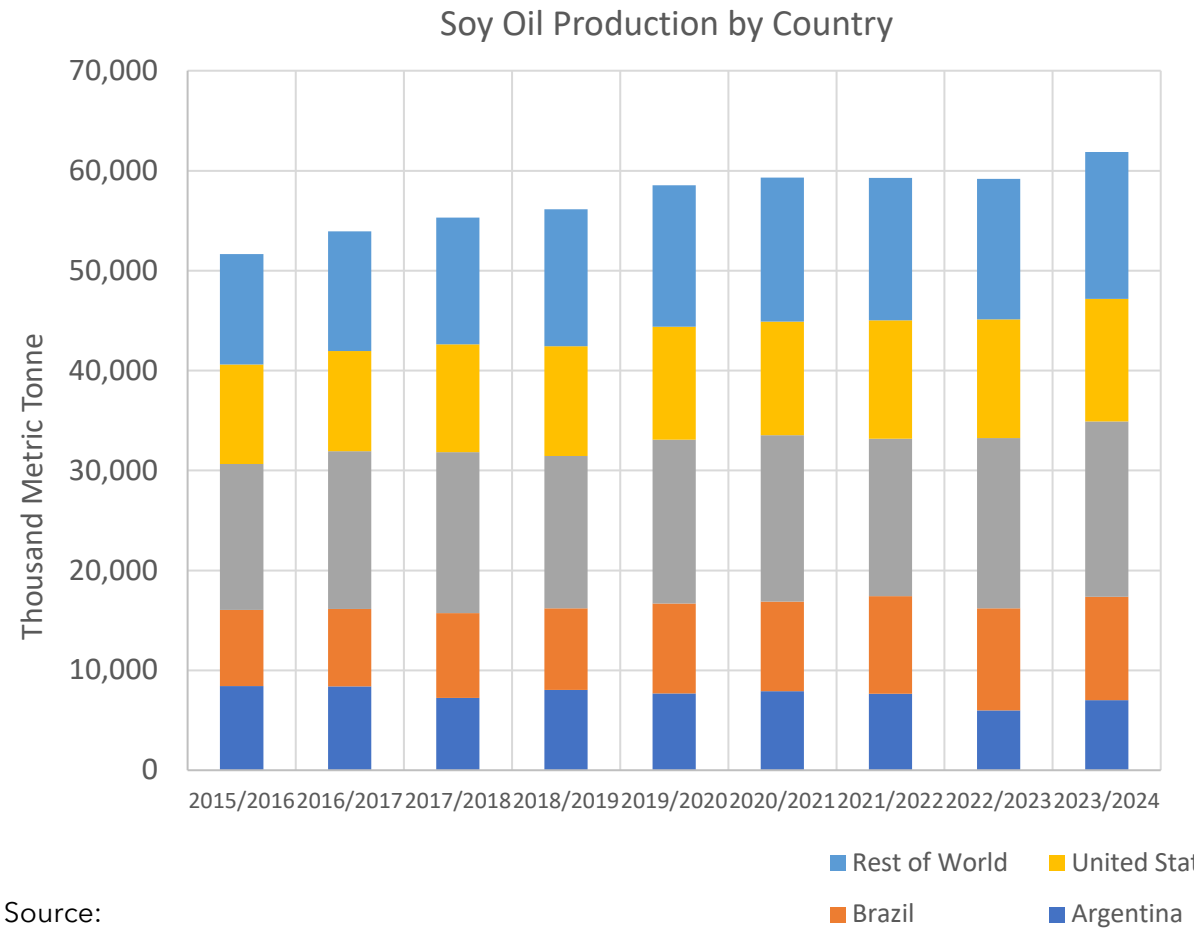
Crop-based Oil Prices

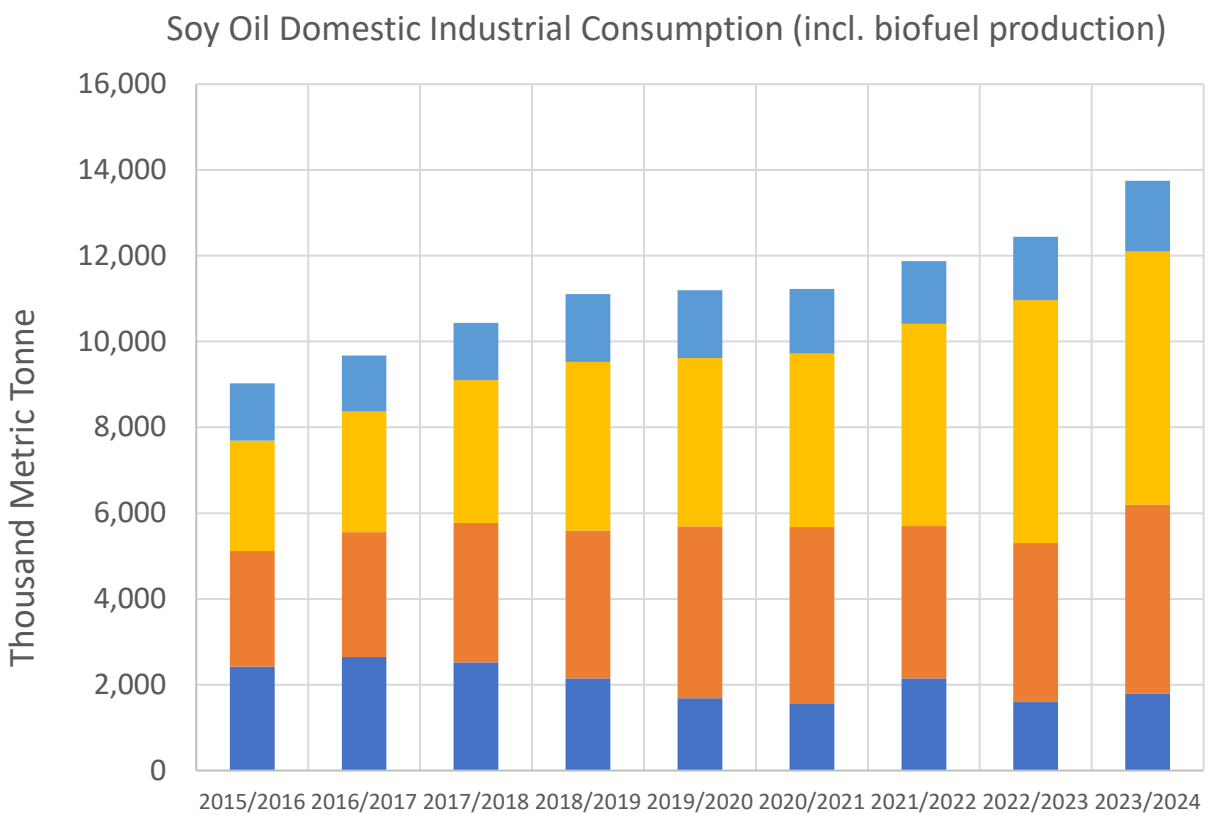
- Rapid rise in oil prices in 2021 and 2022
- Many factors affected oil prices:
  - Pandemic supply disruptions/inflation
  - Lower production from Canada, US, Europe and Ukraine in 2021 of oilseed crops (canola and sunflower) increased soy demand
  - Russian/Ukraine war began in 2022 impacted sunflower oil supply
  - Increased US and international demand for biofuel production



Sources:
UN Food and Agriculture Organization Vegetable Oil Price Index, Jan 2024
USDA *Examining Record Soybean Oil Prices in 2021–22*
USDA *Oil Crops Outlook: May 2023*

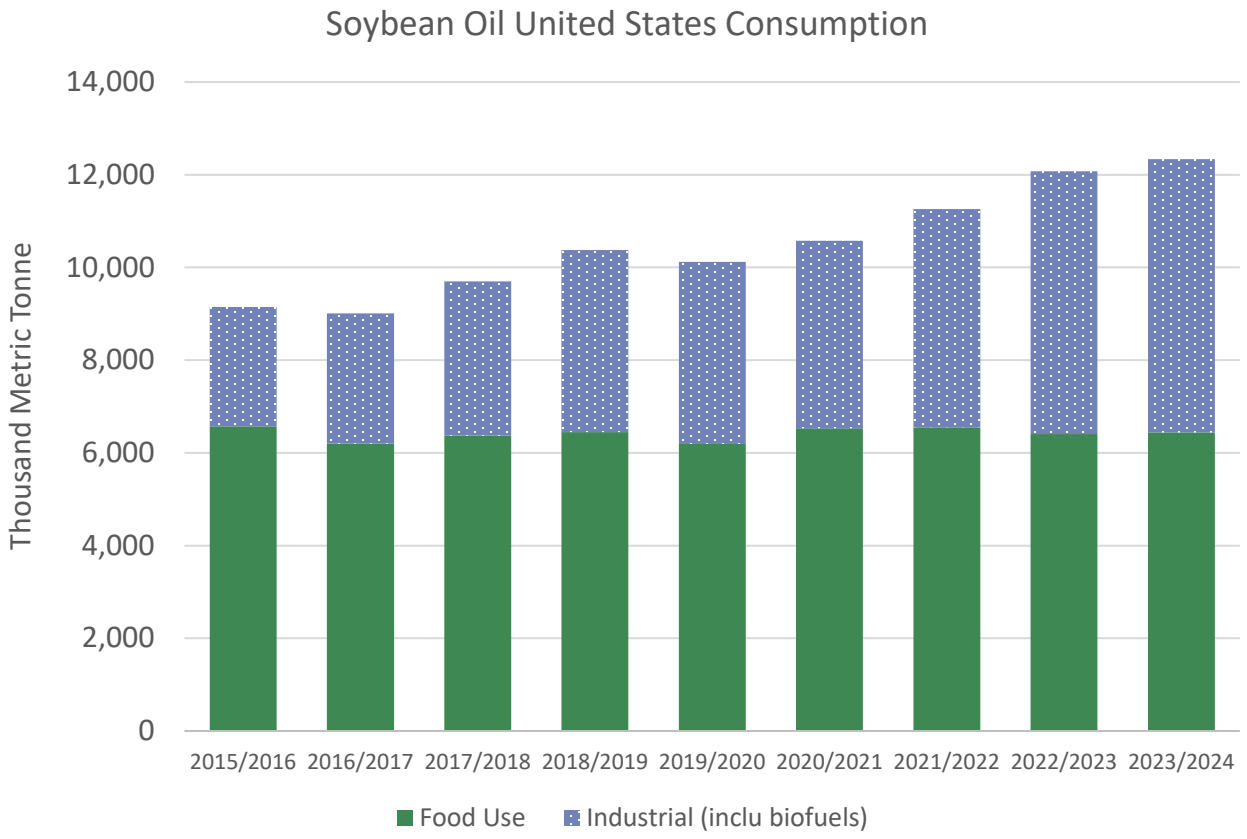
Soy Oil Market Trends – International and U.S.





Source:
USDA Foreign Ag Service:
https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery

Soy Oil Market Trends – U.S. Consumption



- Yield, crush capacity, and acres projected to increase. Exports decreasing.
- Soy oil uses – food (dressing/mayo), fuels (BD, RD, SAF), and bio-plastics
- Soy meal production also increases with oil production.
- Soy meal uses – livestock feed

Source:
USDA Foreign Ag Service:
https://apps.fas.usda.gov/psdonline/app/index.html#/app/advQuery

Data Trends and Guardrails

- CI incentives working to prioritize waste-based feedstocks
- BBD volumes increasing and likely to increase in the future given announced capacities
- Recent virgin oil trends suggest increasing investments and reduced exports are happening to increase virgin oil supply
- Based on current and future understanding of market conditions, it is uncertain if substantial increases in virgin oil fuel use in California will occur over long-term
- Guardrails still warranted to reduce risks of potential impacts from increased demand of virgin oils in CA LCFS and inform other clean fuels program design

Guardrails include multiple mechanisms

Priority	Approach / Strategy
Encourage use of waste-based feedstocks	• CI scores reflect waste-derived fuels • Feedstock tracking for waste feedstocks • For other non-waste-based feedstocks, include GHG emissions coming from feedstocks production and transport. Also include impacts from potential land-use change (LUC)
Minimize/avoid deforestation risks from feedstock production and risks of impacting food prices/availability	• Include LUC in CI scores • Eliminate any crediting for Palm Oil* • Require Sustainability Certification* • Prohibit crop or forestry feedstocks from land forested after 2008* • Consider increases in LUC for certain fuel/feedstock combos** • Additional detailed traceability, verification and/or enforcement of waste feedstocks to avoid fraud**
Reduce other impacts of agricultural practices in feedstock production	• Require Sustainability Certification*

*45-day proposal **Staff are continuing to evaluate these options

Provisions to Encourage Waste Based Feedstocks

- LCFS program accounts for land use change emissions associated with crop-based biofuels and incentivizes waste- and residue-based feedstocks (for which no indirect effects are assigned in LCFS)
- Majority of biomass-based diesel produced from waste feedstocks
  - Waste based feedstocks require are considered a "specified source feedstock"
  - Specified source feedstocks must provide chain-of-custody documentation, which traces feedstock to point-of-origin
- For non-waste feedstocks, carbon intensity score includes land-use change value
  - Land use change quantified in LCFS since 2011
  - Extensive multi-year land use change expert workgroup informed updates to land use change values in 2015 rulemaking*

Proposed Sustainability Language in 45-Day

- Would provide additional protections against deforestation and habitat loss from fuel feedstocks
- Crop or forestry feedstocks cannot come from land that was forested after January 1, 2008
- CARB would leverage existing certification programs
  - ISCC, RBS, REDcert, Bonsucro, etc. (Most already approved under EU Renewable Energy Directive)
  - Requires CARB approval and continuous oversight
- All crop- and forest-based feedstocks requires certification by January 1, 2028

What Sustainability Certifications Typically Include

- No cultivation occurred on areas that serve the purpose of nature protection
- Damage or deterioration of habitats is avoided
- Crops are grown on suitable soils and have good agricultural practices with respect to soil quality, soil contamination and soil erosion
- Fertilizer application does not contaminate the surface and ground water
- Responsible plant protection practices (insect treatments)
- Responsible waste management practices

Proposed LCFS Process in 45-day

- Feedstock providers interested in participating in the LCFS will select a CARB approved certification system
- Feedstock providers must meet all requirements to become certified under the selected program
  - Select a third-third party auditor
  - Auditor will confirm accuracy of registration information and conformance with certification program's sustainability requirements
- Successful process will result in issuance of traceable certificates
- LCFS pathways holders must provide certificates to CARB-accredited verifiers and CARB upon request

Sustainability Audit Process

- Auditors conduct the following tasks:
  - Perform site visit(s)
  - Confirmation of land use change date (before/after 2008)
  - Ensure cropping practices meet sustainability requirements
  - Review of management systems
  - Review of social practices (e.g., worker treatment)
  - Review compliance with, all applicable regional, national laws and international laws
  - Review economic stainability of the applicant (e.g., farm)
- Auditor will require correction or changed before certificates are issued

Land-Use Change Values Under Staff Evaluation

- Under current reg language, applicants use LUC values from Table 6 if their feedstock is listed
- Table 6 values were estimated during CARB's 2015 GTAP analysis and reflect region-specific biofuel shocks (e.g., US soy, Brazilian sugarcane)
- Table 6 values may not be accurate for applicants sourcing feedstocks from outside 2015 analysis area
- Staff is looking into a mechanism to assign higher LUC values than Table 6 to high-risk crop-based feedstocks entering the LCFS as part of the pathway process

Biofuel	LUC (gCO2/MJ)	2015 Analysis Area
Corn Ethanol	19.8	U.S.
Sugarcane Ethanol	11.8	Brazil
Soy Biomass-Based Diesel	29.1	U.S.
Canola Biomass-Based Diesel	14.5	North America
Grain Sorghum Ethanol	19.4	U.S.
Palm Biomass-Based Diesel	71.4	Indonesia/ Malaysia

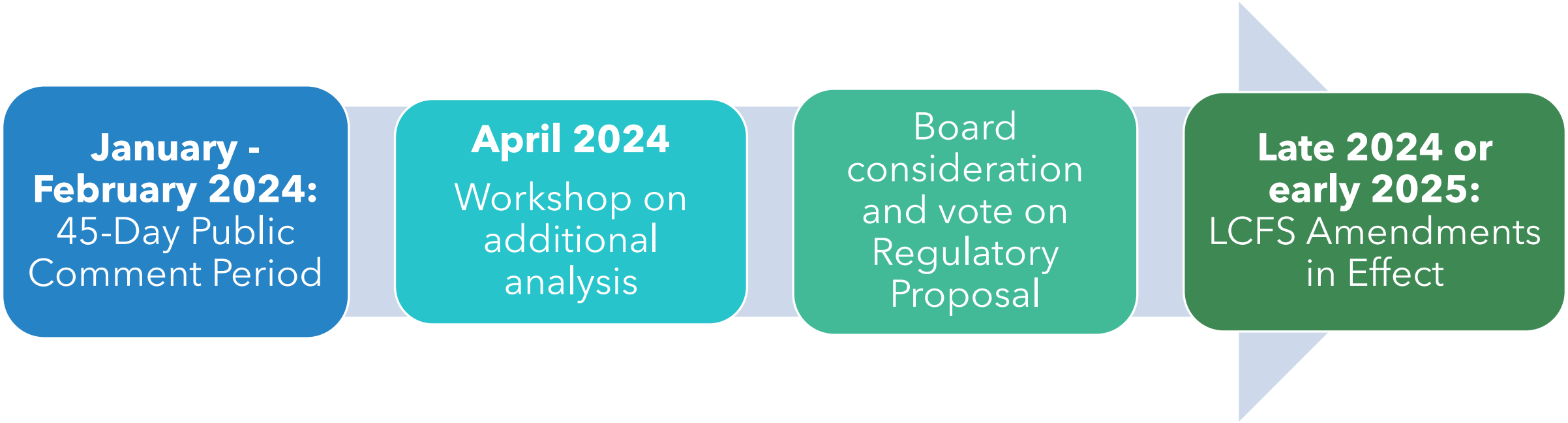
Land Use Change Evaluation – Initial Concept

- As part of an individual fuel pathway, staff would evaluate and provide updated LUC values for a fuel and feedstock combination not covered by a Table 6 value
- LUC evaluation would be based on **empirical** sub-national production data
- Example of potential LUC data sources:
  - Remote sensing studies that attribute LUC to crop feedstock expansion at national or regional scales (e.g., academic research articles)
  - Satellite-based land use monitoring platforms (e.g., Global Forest Watch, Mapbiomas-Brazil) that provide annual tracking of LUC for commodity crop expansion
- Staff is seeking feedback on approach and potential data sources

Staff Summary

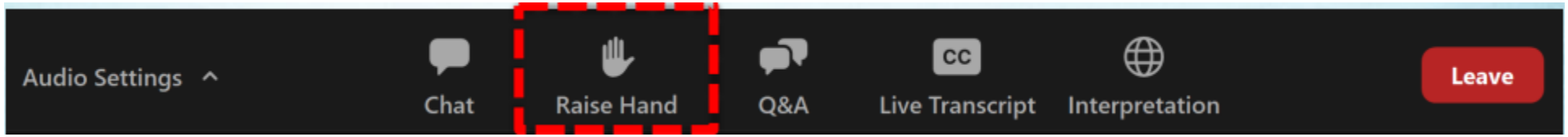
- 45-day proposal aligns with implementation needs of existing ZEV regulations
  - LCFS has supported private investment in ZEV infrastructure and fuels
  - It is not a government directed funding source like GGRF
- Transition to MDV/HDV ZEVS will take longer than transition to LDV ZEVs
  - Science supports the use of alternative fuels in the near-term to continue transition away from petroleum fuels and deliver GHG and AQ benefits, especially diesel
  - Reducing VMT does not reduce diesel demand in MDV/HDV and offroad
- Increased stringency brings additional GHG and air quality benefits, particularly for MHD, but need to balance multiple objectives when considering options for increased stringency.
  - Potential role of E15 to reduce costs at the pump for LD fuel use
- Biofuels market undergoing rapid changes and there is uncertainty on future volumes, guardrails to reduce risks are important.

Rulemaking Timeline



Public Comments

- Process
  - Comments will be taken by in-person attendees and virtually through Zoom
  - 3 minutes per comment
  - Staff will make every effort to call on commenters in the order they signal they would like to comment or raise the hand on Zoom
- Zoom Orientation
  - "Raise Hand" to signal that you'd like make a comment
  - Zoom phone participants may dial #2 to raise your hand
  - Staff will inform Zoom phone participants when they are unmuted during public comment
  - Dial *6 to mute or unmute



Written comments can be submitted after the workshop at:

https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/lcfs-meetings-and-workshops