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Fuel Portfolio Scenario Modeling of 2030 LCFS Targets

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1. Overview of FPSM methods
2. Primary modeling results
3. Scenario and target timing comparison
4. Acceleration Mechanisms
5. Conclusions / future work

Origins of FPSM

- FPSM builds on previous approaches:
  - CARB LCFS Illustrative Compliance Scenario Calculator (2017)
  - California's Clean Fuel Future (2018)
  - Driving California's Transportation Emissions to Zero (2021) *("DtZ study")*
- Not performing optimization or statistical simulation but assembling coherent and comprehensive fuel portfolio with specified and transparent methods.
- Calculating LCFS credit/deficit generation for each portfolio to assess policy compliance.
  - Credit price stability depends on maintaining balance between credit supply and demand.
  - However, credit supply and demand change over time due to changes in technology, economic conditions, and other policy actions.
  - Thus, accurate modeling of LCFS market including credit supply and demand forecast is critical to the success of the program, but it is extremely difficult. FPSM can be part of modeling portfolio.

Fuel Demand and Vehicle Fleet Analysis

Transportation Transitions Model (TTM) – Drs. Lew Fulton and Marshall Miller, with graduate student Qian Wang.

- Models transitions in the vehicle fleet and changes to vehicle activity based on costs of conventional and alternative fueled vehicles including both light-duty and medium & heavy-duty vehicles
- Provides statewide fuel consumption data at highly aggregated level (7 fuel categories).
- Previously used for the *DtZ study* and updated for FPSM: reflecting Advanced Clean Cars 2 (ACC2), Advanced Clean Trucks (ACT) and Advanced Clean Fleets (ACF), and improving alignment with historical fuel consumption.

TTM Vehicle Activity Projections

	LDVs (Billion VMT)							Per-Vehicle ('000s)	
	Gas + FFV	CNG	HEV	PHEV	BEV	FCV	TOTAL	Gas	EV
2020	317.1	0.8	7.9	3.4	6.3	0.0	335.4	12.5	13.1
2021	313.0	0.7	8.6	4.1	8.5	0.1	334.9	12.4	13.7
2022	308.2	0.7	9.3	4.6	12.4	0.1	335.3	12.3	14.5
2023	303.4	0.6	10.1	5.4	16.7	0.2	336.4	12.2	15.0
2024	298.4	0.6	10.8	6.6	21.2	0.4	337.9	12.1	15.3
2025	293.0	0.5	11.5	8.0	26.1	0.7	339.8	12.1	15.5
2026	285.3	0.5	12.2	9.7	32.3	1.1	341.1	11.9	15.5
2027	275.6	0.4	12.8	11.9	40.3	1.4	342.5	11.8	15.5
2028	264.0	0.4	13.4	14.4	50.0	1.8	344.0	11.7	15.4
2029	250.5	0.3	13.9	17.2	61.2	2.3	345.5	11.5	15.4
2030	235.4	0.3	14.4	20.4	73.8	2.8	347.1	11.4	15.3
2031	219.5	0.2	14.5	23.8	87.3	3.4	348.7	11.2	15.2
2032	202.9	0.2	14.2	27.4	101.4	4.1	350.3	11.0	15.0
2033	185.8	0.2	13.6	31.2	116.3	4.9	352.0	10.8	14.9
2034	168.1	0.1	12.7	35.3	132.0	5.7	354.0	10.6	14.7
2035	150.0	0.1	11.6	39.5	148.0	6.7	355.9	10.4	14.6
2036	133.5	0.1	10.5	43.0	162.7	7.9	357.7	10.1	14.3
2037	118.4	0.1	9.5	46.0	177.0	9.3	360.2	9.9	14.2
2038	104.6	0.1	8.5	48.5	190.5	10.8	363.0	9.7	14.0
2039	92.1	0.1	7.7	50.4	203.2	12.6	365.9	9.5	13.8
2040	80.7	0.1	6.8	51.9	215.4	14.6	369.5	9.4	13.7

	MHDVs (Billion VMT)							Per-Vehicle ('000s)	
	Diesel	Hybrid	CNG	BEV	FCV	Gas	TOTAL	Diesel	EV
2020	23.3	0.5	1.0	0.0	0.0	7.2	32.0	21.9	19.8
2021	23.8	0.6	1.1	0.1	0.0	7.0	32.6	22.0	21.7
2022	24.4	0.7	1.1	0.2	0.0	6.7	33.2	22.1	22.1
2023	24.9	0.8	1.2	0.3	0.1	6.6	33.8	22.1	22.2
2024	25.3	0.9	1.2	0.6	0.1	6.4	34.4	22.2	22.2
2025	25.6	1.0	1.3	0.8	0.1	6.2	35.0	22.2	22.0
2026	25.7	1.1	1.3	1.2	0.3	6.0	35.5	22.2	21.8
2027	25.6	1.2	1.3	1.6	0.5	5.7	35.8	22.2	21.5
2028	25.3	1.3	1.3	2.2	0.8	5.5	36.3	22.1	21.2
2029	25.0	1.3	1.2	2.8	1.2	5.3	36.8	21.9	20.9
2030	24.6	1.4	1.2	3.5	1.7	5.2	37.5	21.6	20.7
2031	24.1	1.5	1.1	4.3	2.2	5.0	38.2	21.3	20.4
2032	23.4	1.6	1.1	5.1	2.8	4.8	38.9	20.9	20.1
2033	22.5	1.6	1.0	6.0	3.5	4.6	39.2	20.7	19.9
2034	21.4	1.7	0.9	6.9	4.3	4.3	39.5	20.5	19.6
2035	20.2	1.7	0.9	7.9	5.1	4.0	39.8	20.2	19.4
2036	18.9	1.7	0.8	9.0	6.0	3.7	40.1	19.9	19.1
2037	17.6	1.7	0.7	10.1	7.0	3.4	40.4	19.6	18.8
2038	16.1	1.6	0.6	11.2	8.1	3.0	40.7	19.2	18.6
2039	14.6	1.5	0.6	12.4	9.2	2.7	40.9	18.8	18.3
2040	12.9	1.3	0.5	13.7	10.4	2.4	41.2	18.2	18.0

- Annual fuel consumption projections for 7 categories of fuel: Gasoline, gasoline substitutes, diesel, diesel substitutes, electricity, natural gas, and hydrogen

FPSM Methods

FPSM allows rapid and customized analysis with selections of:

- Multiple fuel demand scenarios (TTM results selection)
- Carbon intensity (CI) reduction target trajectories
- Control parameter schemes

General approach is bottom-up: Aggregate and curate projections of fuel availability where available. Otherwise, use linear projection based on historical data.

Model defaults generally retained from the *Driving California's Transportation Emissions to Zero by 2045* report (extensively reviewed by State regulatory agency staff and academics), user can specify alternatives.

Control Parameters

Carbon intensity (CI) improvement rate	Unit		Selected
Starch Ethanol (post-) (put year value in cell D5)	%		2.0%
Sugar Ethanol (post-) (put year value in cell D6)	%		4.0%
Cellulosic Ethanol (post-2030) (put year value in cell D7)	%	2030	4.0%
Biodiesel (post-2030)	%	2030	N/A
Renewable Diesel (post-2030)	%	2030	N/A
Sustainable Aviation Fuel (post-2030)	%	2030	N/A
Initial carbon intensity - Renewable Gasoline	gCO2e/MJ		35.0
Renewable Gasoline (post-2025)	%	2025	3.0%
Renewable Naphtha (post-2025)	%	2025	3.0%
Hydrogen (post-2030)	%	2030	6.0%
Renewable NG (post-2030)	%	2030	4.0%
Goals and growth rates by fuel type			
Electricity			
LD EV Credit Adjustment plan - start	year		NA
LD EV Credit Adjustment plan - duration	years		NA
HD EV Credit Adjustment plan - start	year		NA
HD EV Credit Adjustment plan - duration	years		NA
Zero-carbon Electricity grid goal	year	0	2045
Low-CI or smart charging of residential reaches 99% by	year	99%	2040
Low-CI of non-residential reaches 99% by	year	99%	2035
eForklift credits phase out - starting year	year		NA
eForklift credits phase out - duration	years		0
eForklifts growth rate	%		3.0%
Fixed Guideway (before 2030)	%	2030	1.0%
Fixed Guideway (after 2030)	%	2030	3.0%
eOGV/eCHE/eTRU	%		3.0%
Liquid Gasoline Substitutes			
Renewable Gasoline Cap Goal 1 - year	year		2030
Renewable Gasoline Cap Goal 1 - volume	mm GGE		200
Renewable Gasoline Cap Goal 2 - year	year		2040
Renewable Gasoline Cap Goal 2 - volume	mm GGE		1,000
Renewable Gasoline (after Cap Goal 2 year) growth rate	%	2040	0.0%
Cellulosic Ethanol goal (by 2030)	mm gal	2030	300
Cellulosic Ethanol volume growth rate	%	2030	5.0%

Distillates			
Growth rate - each feedstock availability	%		1%
Off-road adjustment for diesel pool consumption			5%
Off-road adjustment phasing out start year			2035
SAF goal in California (by 2030)	mm GGE	2030	477
Aviation demand growth rate	%	2035	2.5%
	%	2035	0.9%
Average Fleet-Wide Fuel Economy Increase (Aviation)	%		1.4%
Natural Gas			
RNG potential selection		2040	Low
Dairy gas negative CI phase out start			2035
Dairy gas negative CI phase out end			2040
Project and Infrastructure Credits			
Refinery Investment Credit Cap (% of prior year deficits)	%		2.5%
Renewable Hydrogen Refinery Credit goal by 2030	MMT	2030	-
Renewable Hydrogen Refinery Credit Cap (% of prior year deficits)	%		2.5%
Infrastructure cap (% of prior year deficits) (HRI, FCI)	%		2.5%
FCI / HRI last year	year		2025
FCI crediting years	years		5
HRI crediting years	years		15
Innovative Crude Credit goal by 2030	MMT	2030	-
Blend rate and fraction			
Biodiesel Blend Rate (of total liquid diesel and substitutes) by	year	6%	2050
Biodiesel blend rate after 2050	%	2050	6.0%
Keep current Ethanol fraction (11 vol%) by	year	11%	2030
Ethanol fraction after 2030	%	2030	16.0%
(Sugar Ethanol) / (Sugar Ethanol + Starch Ethanol)	Vol %		8.0%
Naphtha fraction of RD for co-processing to gasoline	Vol %		5.0%
Renewable Propane as fraction of RD	Vol %		4.0%
Lipids capacity			
Annual Maximum Distillates Capacity (lipid-based)	mm DGE		1,750
Annual Maximum Distillates Capacity growth rate	%		0.0%

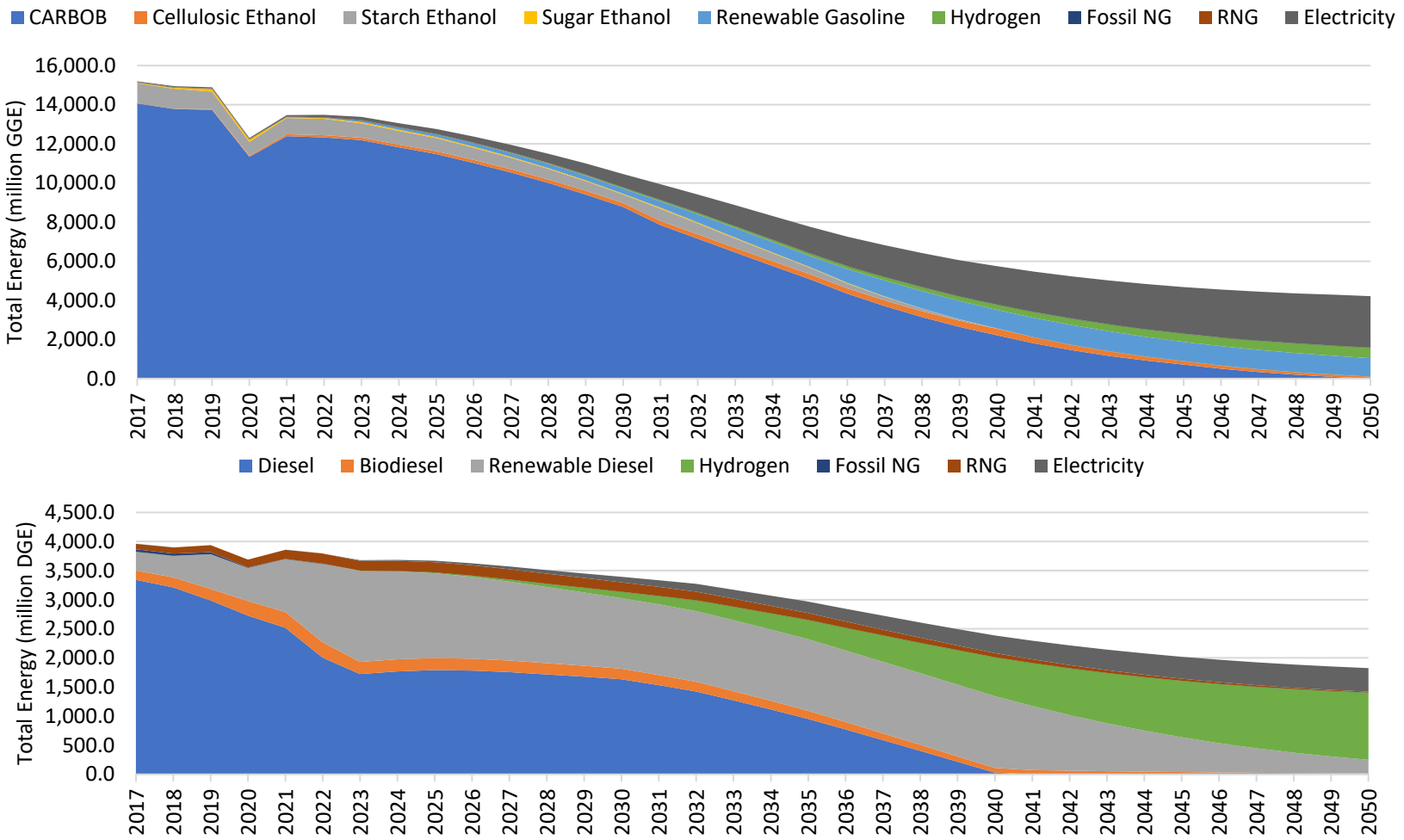
FPSM Methods Overview

- Preprocessing of CARB historical data and TTM results for merging
  - Matching the TTM categories and aligning with CARB historical data
- Gasoline and liquid gasoline substitutes
  - Dividing total liquid substitutes into ethanol and renewable gasoline according to user-specified assumptions
  - Assume shift to E15 standard in 2031
  - 200 million gal per year drop-in low-carbon (< 35 g/MJ CI) gasoline substitute by 2030 and 1 billion gal per year by 2040 (needed for 2045 carbon neutrality)
  - 300 million gal per year low-carbon (cellulosic or CCS) ethanol by 2030
- Natural gas
  - Renewable natural gas (RNG) supply: using California's population-weighted share of the U.S. national RNG supply
  - RNG demand: satisfied by the lowest-CI sources first

FPSM Methods Overview

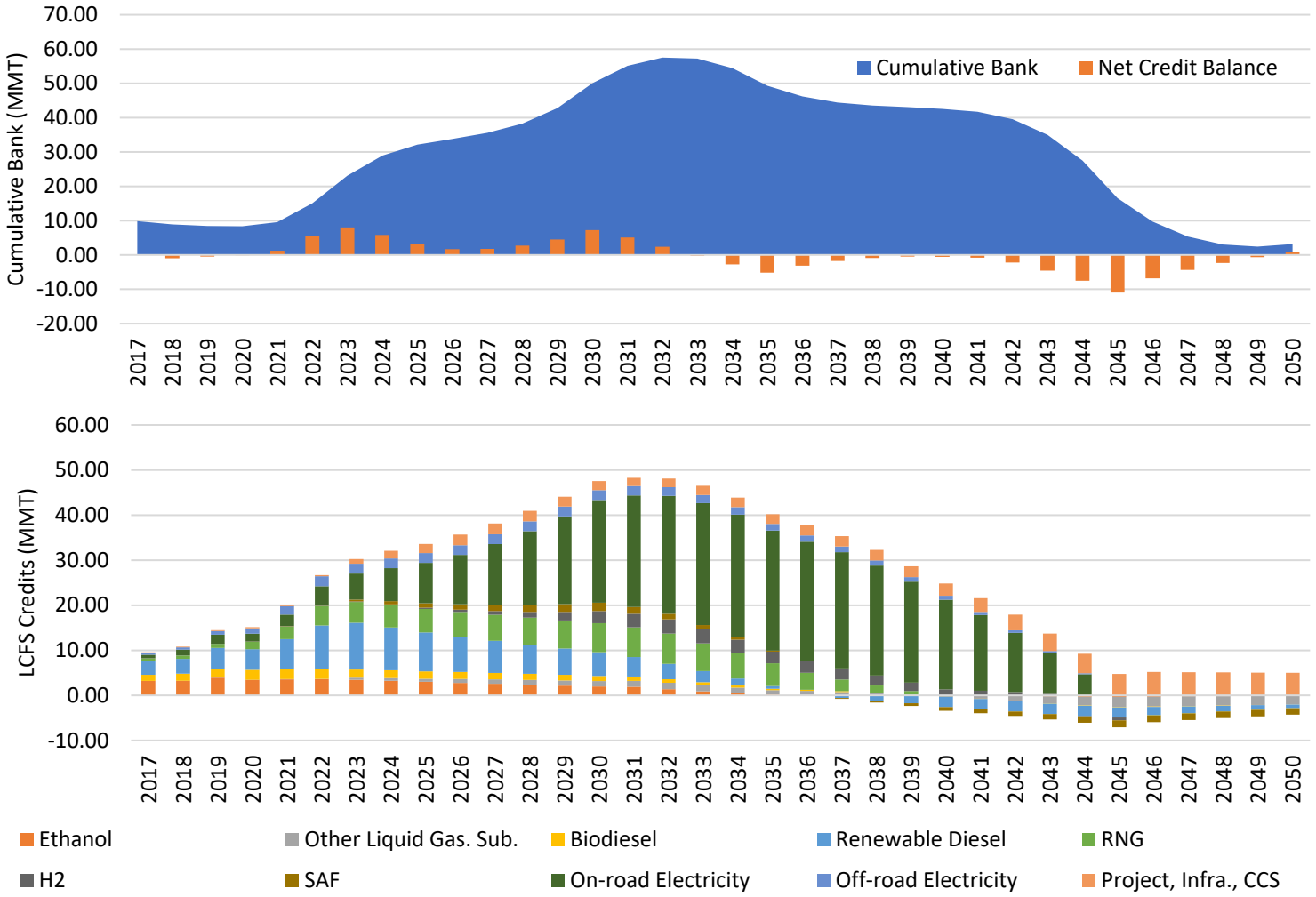
- Diesel, liquid diesel substitutes, and aviation fuel (Lipid-based fuels)
  - Feedstock constraints added for lipid-based fuels to avoid RD runaway (1.75 billion DGE/yr total for SAF+RD+BD).
  - SAF demand satisfied first (477 mm gal/yr in 2030), then BD blending, residual lipid capacity goes to RD
  - Currently assuming no significant deployment of cellulosic diesel or SAF by 2030
- Electricity
  - Disaggregate TTM total electricity into LCFS categories: (LDV, MHDV, Offroad) (grid-average, low-CI) (residential, non-residential charging)
  - Electricity grid is assumed to go to zero-carbon by 2045.
- Other Credits & Deficits– Hydrogen, project-based, DAC-CCS, incremental crude deficits, etc.
  - 1 million of total project-based (refinery/crude) credits are generated in 2030
  - Existing HRI/FCI protocols hit 2.5% cap but are not renewed or expanded.

Fuel Portfolio Outputs



- FPSM generates disaggregated fuel portfolios.
- Declining energy consumption is due to shift to higher-efficiency vehicles (EV & HFCV)

LCFS Credit Outputs



- Based on fuel scenarios, model assumptions, and LCFS target, LCFS compliance is estimated.
- FPSM nominally extends through 2050, however post-2035 results are ***highly uncertain***

Final thoughts on methods

- FPSM projects credit and deficit generation under specified assumptions, from that we can estimate credit balance.
  - FPSM does not attempt to simulate market response to credit balance or other LCFS parameters.
  - We do not attempt to estimate price (working on a different model that will project credit prices).

- We are reasonably confident in this model's ability to provide useful policy guidance out through 2035.
  - Policy guidance ≠ accurate prognostication
- LCFS market will be fundamentally different after 2035, no model exists to effectively address that time period

Scenarios of Interest

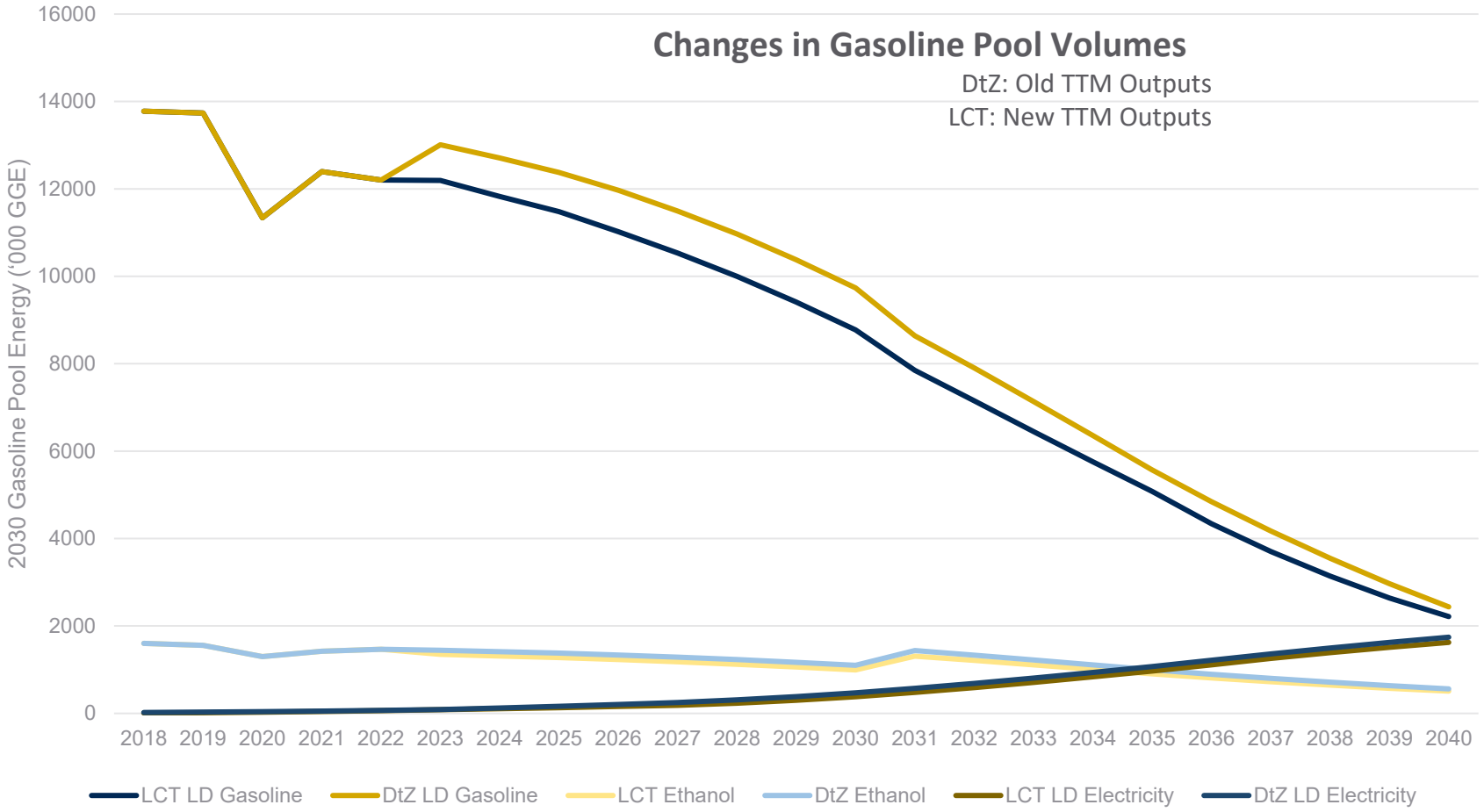
Low-Carbon Transition Scenario – "LCT" – Includes updated TTM model runs and historical data through 2022. Assumes ACC2, ACT, ACF implemented fully.

Driving to Zero Scenario – "DtZ" – Scenario generated as part of 2021 *Driving California's Transportation Emissions to Zero by 2045* report. Historical data through 2019. Assumes full rebound of driving to pre-COVID levels, slightly lower overall ZEV deployment, of which a larger share are HFCVs.

BAU – Assumes no ACC2/ACT/ACF. Not presented here due to limited policy relevance

High Fuel Cell Scenario – Not presented, very similar to LCT through 2030.

Difference in Gasoline Demand – LCT and DtZ



Primary difference between old and new model runs is assumption regarding post-COVID gasoline market trajectory.

DtZ functions as a high-gasoline-demand sensitivity scenario.

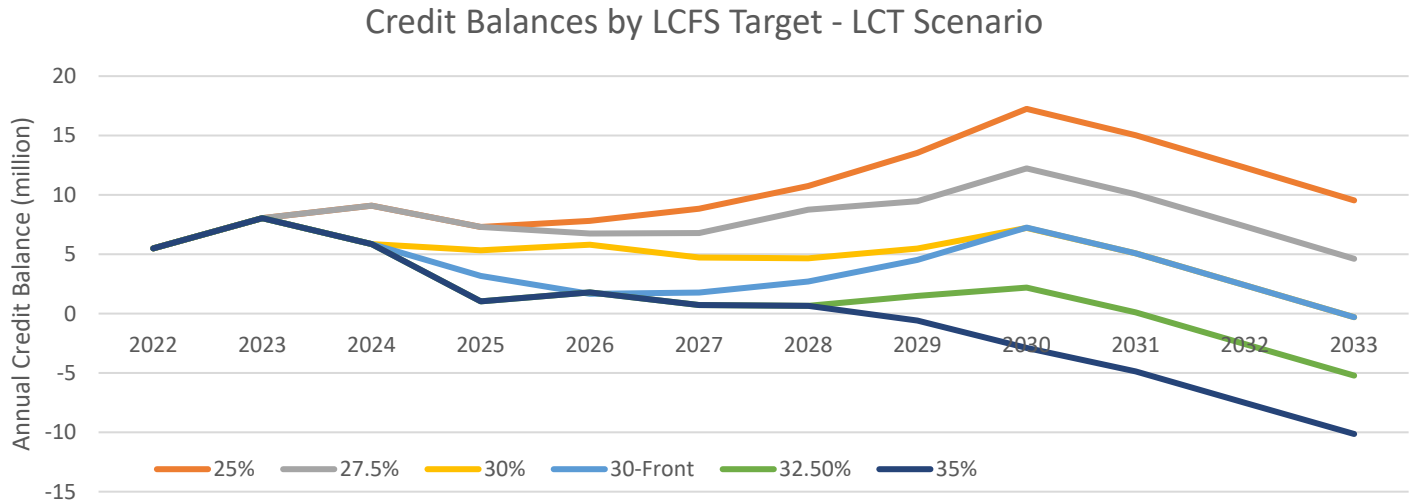
Target Trajectories Examined

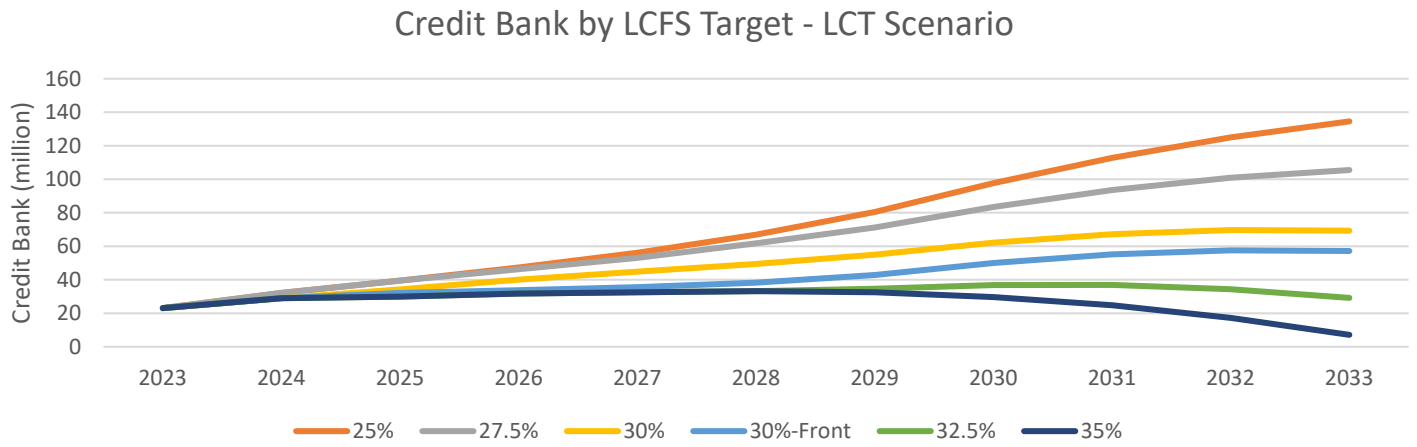
	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
20% by 2030 Current Policy	10.00%	11.25%	12.50%	13.75%	15.00%	16.25%	17.50%	18.75%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
25% by 2030	10.00%	11.25%	12.50%	15.00%	17.00%	19.00%	21.00%	23.00%	25.00%	31.00%	37.00%	43.00%	49.00%	55.00%	59.00%	63.00%	67.00%	71.00%	75.00%
27.5% by 2030	10.00%	11.25%	12.50%	15.00%	17.50%	20.00%	22.00%	25.00%	27.50%	33.50%	39.50%	45.50%	51.50%	57.50%	61.25%	65.00%	68.75%	72.50%	76.25%
30% by 2030	10.00%	11.25%	14.00%	16.00%	18.00%	21.00%	24.00%	27.00%	30.00%	36.00%	42.00%	48.00%	54.00%	60.00%	63.50%	67.00%	70.50%	74.00%	77.50%
Front-Loaded 30%	10.00%	11.25%	14.00%	17.00%	20.00%	22.50%	25.00%	27.50%	30.00%	36.00%	42.00%	48.00%	54.00%	60.00%	63.50%	67.00%	70.50%	74.00%	77.50%
32.5% by 2030	10.00%	11.25%	14.00%	18.00%	20.00%	23.00%	26.00%	29.00%	32.50%	38.50%	44.50%	50.50%	56.50%	62.50%	65.75%	69.00%	72.25%	75.50%	78.75%
35% by 2030	10.00%	11.25%	14.00%	18.00%	20.00%	23.00%	26.00%	30.00%	35.00%	41.00%	47.00%	53.00%	59.00%	65.00%	68.00%	71.00%	74.00%	77.00%	80.00%

Extremely rapid target acceleration required as ZEV sales fractions approach 100%, otherwise massive credit surpluses. All scenarios assume 6% per year post-2030 increase for comparison.

- In following graphs, 20% 2030 target omitted – does not come close to balancing LCFS market under either scenario.
- Target trajectories not perfectly linear.
- CARB indicated interest in 25%, 30%, and 35% targets in pre-rulemaking workshops.
  - Auto acceleration mechanism and other program changes may impact long-run targets
  - DtZ and LCT omit other proposed changes

Comparing Target Trajectories – LCT Scenario





30% target slows bank growth, but doesn't stop it.

Front-loaded 30% target comes close to market balance, until end of the decade.

35% target depletes credit bank by 2034.

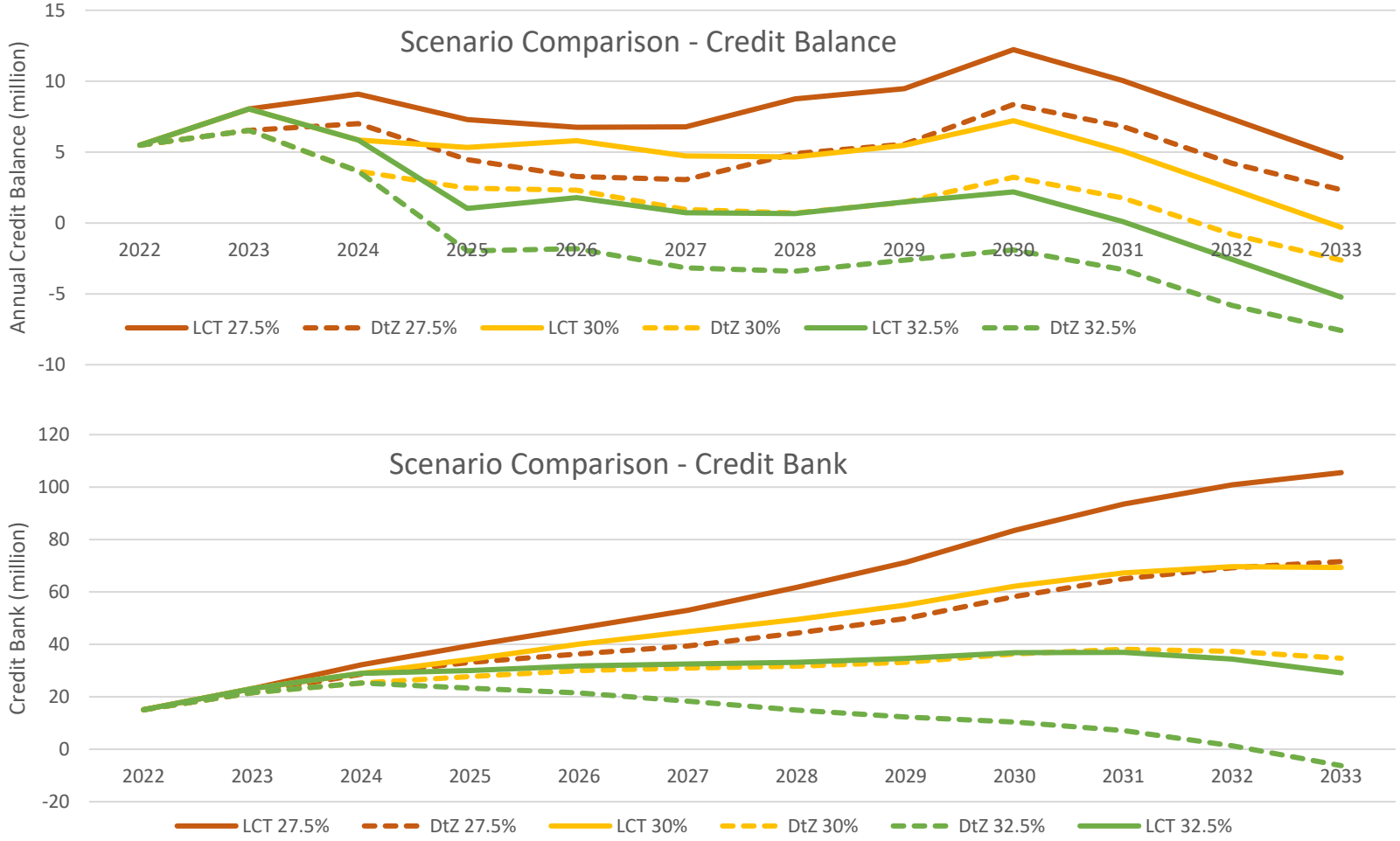
Sources of Credits & Deficits- 2030

	Credit (million)	Volume ('000 DGE/GGE)
Petroleum Gasoline	-32.73	8,774.1
Ethanol	1.98	677.9
Cellulosic Ethanol	1.04	204.6
Starch Ethanol	0.79	435.4
Sugar Ethanol	0.15	37.9
Other Liquid Gasoline Substitute	1.21	261.8
Petroleum Diesel	-6.62	1,633.1
Biodiesel	1.14	181.5
Renewable Diesel	5.26	1,210.8
RNG	6.45	169.1
Total Hydrogen	2.68	
LD H2	0.95	51.4
HD H2	1.73	111.7
SAF	1.84	477.0
Total Electricity	24.99	
On-road Electricity (incl. RE credits)	22.80	
LD Electricity	18.34	685.3
HD Electricity	4.46	95.2
Other (off-road) Electricity	2.18	97.7
Incremental Crude Deficits	-0.96	
Projects, Infrastructure, CCS	2.01	
Total Deficits	40.32	
Total Credits	47.56	

Credit generation assumes 30% target.

LD EVs generate ~40% of credits by 2030. RNG and diesel substitutes (BD & RD) supply ~15% each. MD/HD EVs supply ~10%.

Comparing LCT and DtZ Scenarios

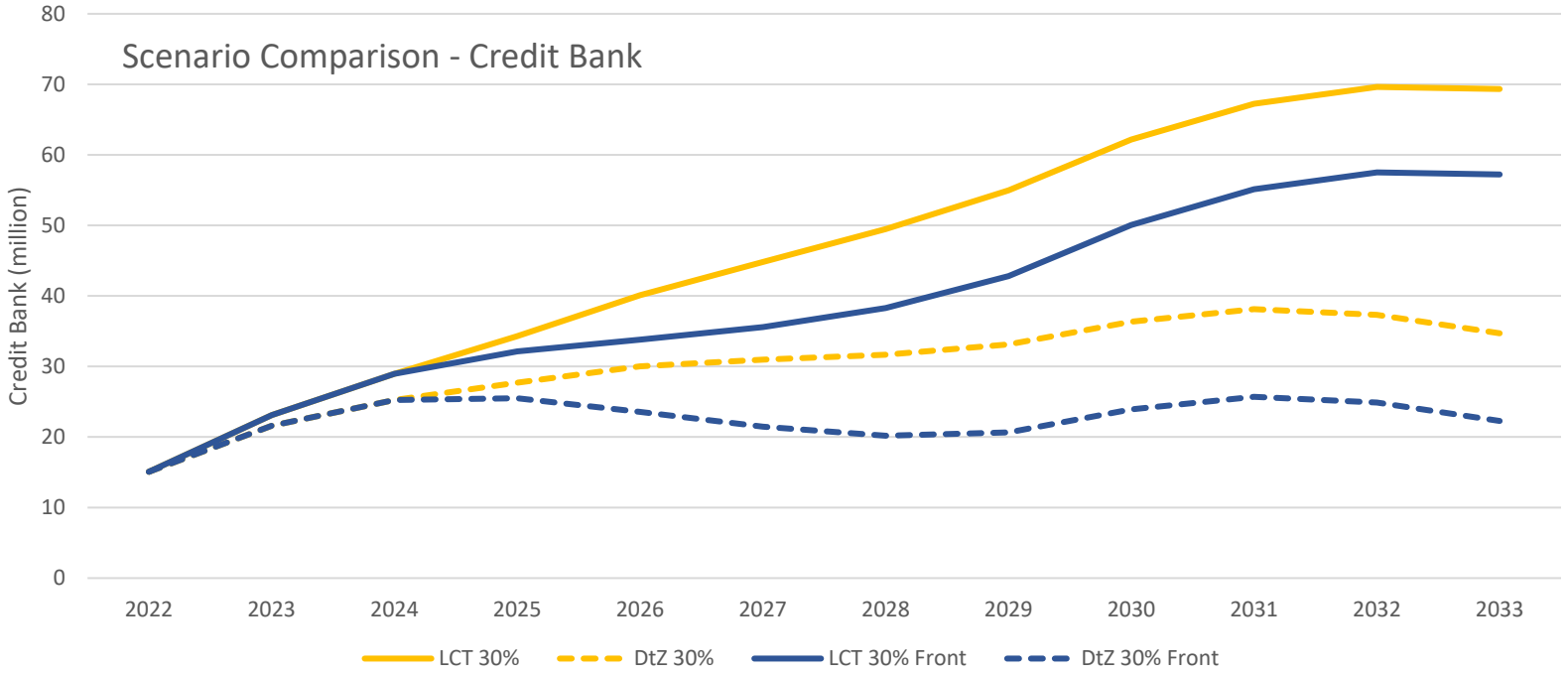


Gap between LCT and DtZ ends up approximately equivalent to 2.5 percentage points of 2030 target stringency.

32.5% target under LCT scenario yields approximately flat bank until early 2030's but rapidly depletes the bank under DtZ.

30% target (not frontloaded) under DtZ scenario yields approximately flat bank until early 2030's.

Closer Examination of Frontloading



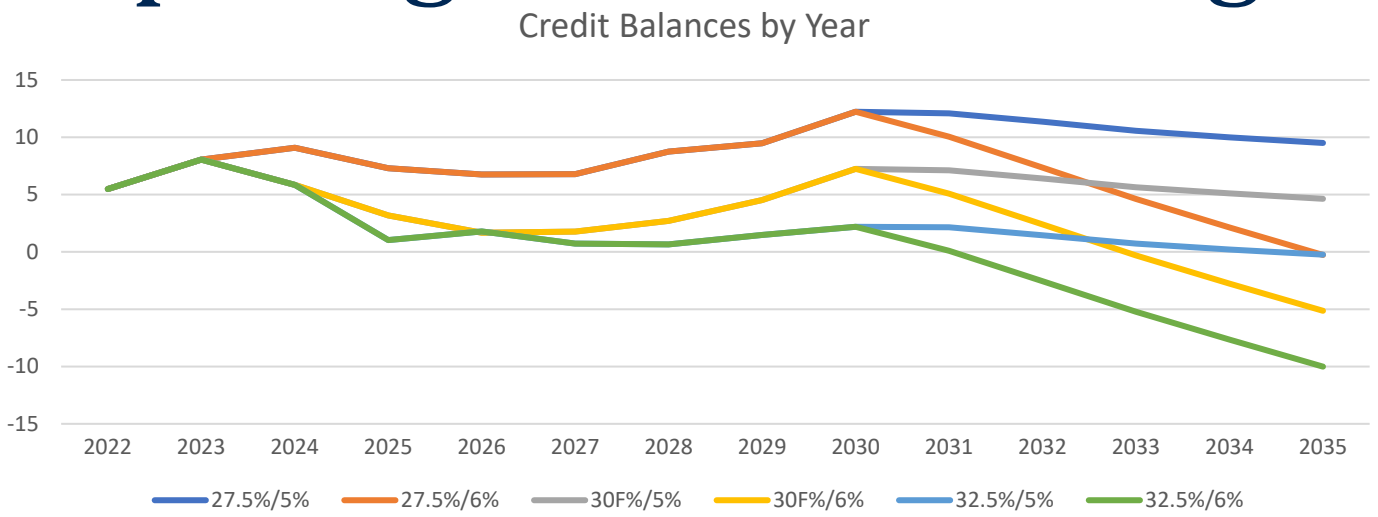
	2022	2023	2024	2025	2026	2027	2028	2029	2030
30% by 2030	10.00%	11.25%	14.00%	16.00%	18.00%	21.00%	24.00%	27.00%	30.00%
Front-Loaded 30%	10.00%	11.25%	14.00%	17.00%	20.00%	22.50%	25.00%	27.50%	30.00%

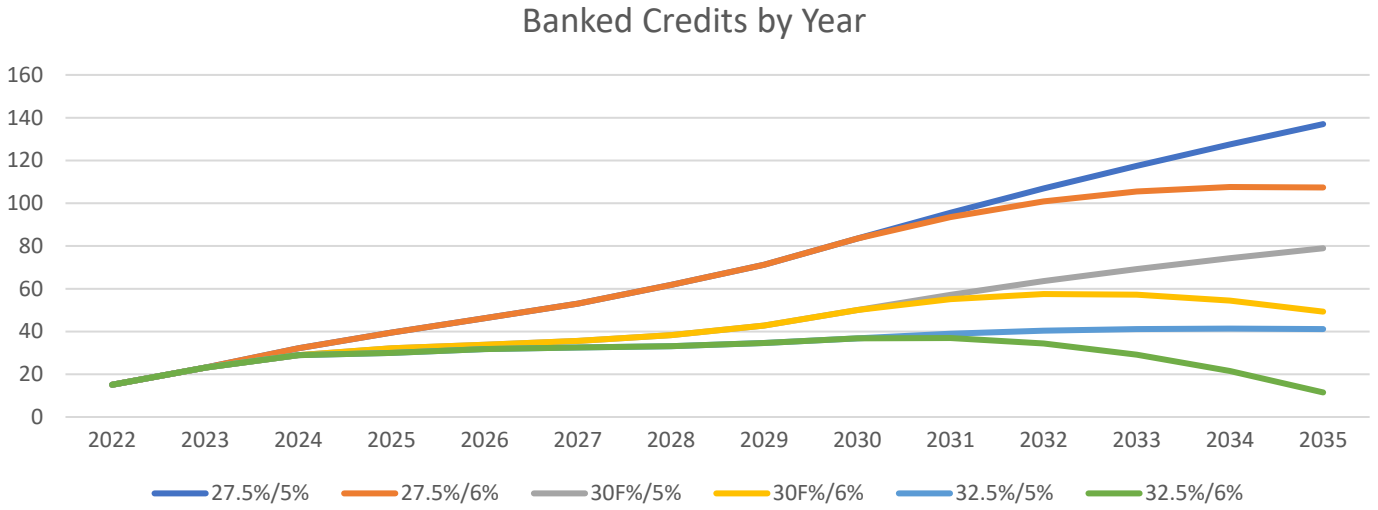
Frontloaded 30% trajectory: Cumulative impact ~12 million deficits in addition to basic 30% through 2030.

Frontloading significantly reduces bank growth through 2030.

These scenario targets differ by at most, 2 percentage points. Shows very strong credit bank/balance sensitivity to small changes in target.

Comparing Post-2030 Target Trajectories





Graphs are for LCT scenario

Comparing 27.5%, Front-loaded 30% and 32.5% trajectories from earlier slide, w/ 5% and 6% annual post-2030 target increases

Target must accelerate that rapidly due to rapid expansion of LD EV fleet, plus policy-driven changes.

Early ambition means post-2030 growth can be more rapid without depleting bank, and vice versa.

Impacts on Retail Gasoline (E10) Cost

Net E10 Costs from LCFS at specified target and credit prices (static 2022 dollars)

	30%	40%	50%	60%
$50	$ 0.17	$ 0.22	$ 0.28	$ 0.34
$100	$ 0.33	$ 0.44	$ 0.56	$ 0.68
$150	$ 0.49	$ 0.67	$ 0.84	$ 1.01

Estimated fraction of gasoline ICE in LDV fleet

2030	2032	2034	2036
77%	69%	59%	49%

Overestimated Displacement

2030 Grid Electricity CI (gCO2e/MJ)	47.4
2030 Gasoline Pool Target (@30%)	69.6
LD Electricity Consumed (mm GGE)	685
LD Pathway Credits (Current LCFS Method, million)	15.5
LD EV Credits (If EER=1)	1.8
LD EV Credits (Displacement)	13.7

In 2030, approximately 20% of the LD fleet will be ZEV. Current credit generation method assumes every MJ of electricity supplied to LD EV displaces precisely 3.4 MJ of gasoline, at all times and under every scenario.

A significant fraction, though less than 20%, of the displacement credits in 2030 are being issued for emissions reductions that do not actually occur. The magnitude of this error increases as the fraction of ICE vehicles decreases.

For a full discussion see:
Improving Credit Quantification Under the LCFS: The Case for a Fractional Displacement Approach (report)

Fractional Displacement Crediting Under the LCFS (brief)

Revisiting Points of Uncertainty

- In-state EV deployment rates.
  - Will EV fleet follow ACC2 projections?
  - Do EVs leave the state on secondary market? Will out-of-state ICE vehicles enter CA?
- VMT and fuel consumption trends.
  - Has COVID rebound completed?
  - Will VMT ever stop growing?
- Renewable diesel and sustainable aviation fuel (SAF) carbon intensity.
  - Will CA be out-competed for low-CI feedstock?
  - How would a crop based feedstock cap impact fuel availability?
- Project-based credits
  - Infrastructure Capacity Credits at <50% of cap. Other project credits near zero. Will this continue?
- Livestock renewable natural gas (RNG) growth trends
  - Will changes to avoided methane credits shift RNG CI scores?

Final Thoughts

- Structural LCFS credit balance is sensitive to relatively small (1-2 percentage point) changes in target in any given year.
- Normal market response will adapt to some of that variability, however much of that adaptation occurs by varying amount of drop-in biofuels, esp. lipid-based ones (biodiesel & renewable diesel).
- Lipid supply can still grow, but most growth will be from crop-based oils that present sustainability and land use change concerns.
  - Do we want to grow these at maximum possible rate?
- Modeling the LCFS, in light of rapid transformation is critical and requires ongoing investment.
  - Work presented here was predominantly done with one-time funds.

Auto-Adjustment Mechanism

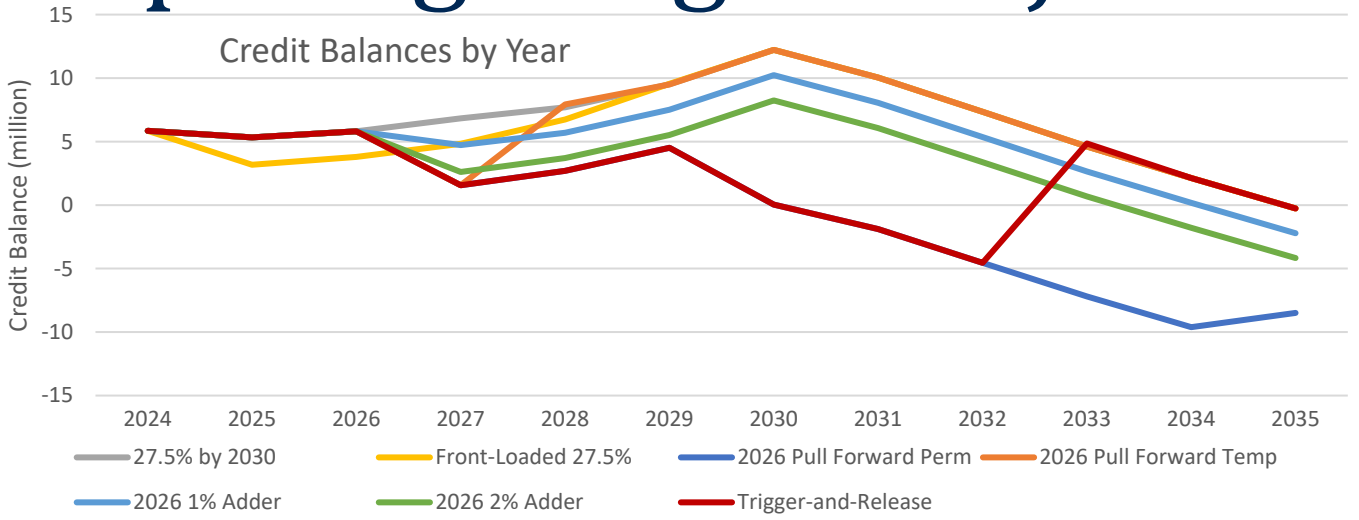
Acceleration Mechanism Scenarios

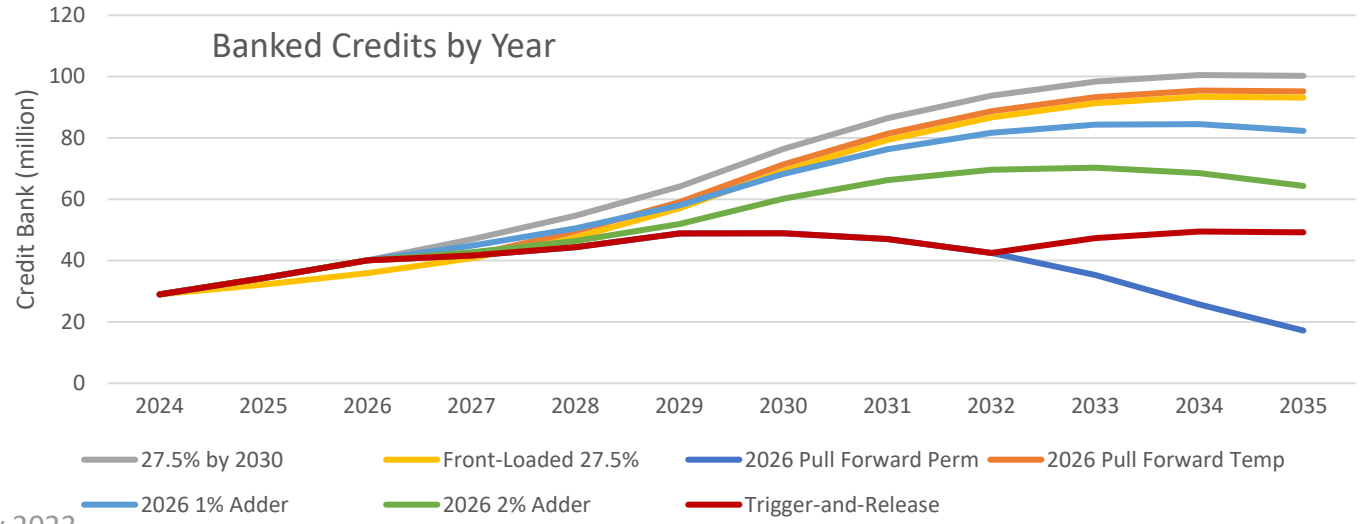
Target trajectories in LCT scenario:

Target	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
27.5% by 2030	11.25%	14.00%	16.00%	18.00%	20.00%	22.50%	25.00%	27.50%	33.50%	39.50%	45.50%	51.50%	57.50%
Front-Loaded 27.5%	11.25%	14.00%	17.00%	19.00%	21.00%	23.00%	25.00%	27.50%	33.50%	39.50%	45.50%	51.50%	57.50%
2026 Pull Forward Perm	11.25%	14.00%	16.00%	18.00%	22.50%	25.00%	27.50%	33.50%	39.50%	45.50%	51.50%	57.50%	61.75%
2026 Pull Forward Temp	11.25%	14.00%	16.00%	18.00%	22.50%	22.50%	25.00%	27.50%	33.50%	39.50%	45.50%	51.50%	57.50%
2026 1% Adder	11.25%	14.00%	16.00%	18.00%	21.00%	23.50%	26.00%	28.50%	34.50%	40.50%	46.50%	52.50%	58.50%
2026 2% Adder	11.25%	14.00%	16.00%	18.00%	22.00%	24.50%	27.00%	29.50%	35.50%	41.50%	47.50%	53.50%	59.50%
Trigger-and-Release	11.25%	14.00%	16.00%	18.00%	22.50%	25.00%	27.50%	33.50%	39.50%	45.50%	45.50%	51.50%	57.50%

Extremely rapid target acceleration required as ZEV sales fractions approach 100%, otherwise massive credit surpluses. All scenarios assume 6 percentage point per year post-2030 LCFS target increase for comparison (except trigger-and-release).

Comparing Target Trajectories





Permanent pull-forward brings rapid acceleration period onto market before ZEV transition has progressed enough to support it. Significant risk of persistent credit shortage.

Temporary measures make minimal difference (assuming no broad market shift).

	Credit Bank (millions)			
	2030	**Δ**	**2035**	**Δ**
27.5% by 2030 (baseline)	76		100	
Front-Loaded 27.5% by 2030	69	-7	93	-7
2026 Pull Forward Perm	49	-27	17	-83
2026 Pull Forward Temp	71	-5	95	-5
2026 1% Adder	68	-8	82	-18
2026 2% Adder	60	-16	64	-36
Trigger-and-Release	49	-27	49	-51

Conclusions

FPSM allows for relatively granular, though non-dynamic projection of fuel portfolios and LCFS compliance. LCT and DtZ are useful scenarios to explore high and low gasoline demand outcomes.

EVs generate almost 50% of 2030 LCFS credits. Lipid based diesel substitutes and RNG about 15% each.

Hydrogen and drop-in gasoline < 10% of 2030 credits, but become more important in 2035 and beyond

2030 target must be above 25% to approach market balance. 35% likely to completely deplete bank before 2035.

30% +/- 2.5% appears to be promising range for effective 2030 program targets.

Feasible target levels are impacted by other program changes, e.g. additional capacity credits, crop-based feedstock cap, credit methodology changes

My opinions:

- LCT scenario may be a touch optimistic, given continued COVID rebound, difficulty reducing per-capita VMT, and likelihood that EV fleet may slightly lag VISION model projections.
- LCFS gas cost impacts have been low to date but will increase as target goes up. The benefits are worth it, but we should take the risk of regressive impact seriously.
  - Delay maximum ambition, provided it's consistent with carbon neutrality goal, to reduce number of drivers exposed to higher gas prices
- Fixing overestimation of fuel displacement by EVs/HFCVs reduces the need for high nominal targets as well as need to withdraw fuel/vehicle categories from program *ad-hoc*
- Critical need for LCFS to address structural issues: Indirect Land Use Change (ILUC) and Energy Economy Ratio (EER) values, additionality assessment, 2035 targets.
- If the decision were mine: Front-loaded 30% 2030 target, with trigger-and-relax pull-forward acceleration mechanism, plus cap on crop-based feedstocks. Announce 2024 or 2025 rulemaking to deal with structural issues and adopt Fractional Displacement crediting.

Next Steps

- Slides will be circulated to registration list and posted on our website: lowcarbonfuel.ucdavis.edu
- Report being finalized, should be circulated shortly (likely after the Asilomar conference next week). Will submit for peer-reviewed publication thereafter.
- Contact us for scenario analysis or thoughts about future model development
- LCFS rulemaking expected to open soon

We Are Happy to Answer Questions!

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