Simulating an “EJ Scenario” for the Low Carbon Fuel Standard Rule update using the ARB CATS Model

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Introduction

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- Leads team working with EJ advocates to conduct modeling to understand impact of EJ policy asks, using ARB's CATS model.
- Stanford team composed of energy researchers, postdoc, graduate students and undergraduates worked to evaluate assumptions and EJ scenarios.
- Team members: Mareldi Ahumada Paras, Mike Mastrandrea, Henry Zhu, Claire Morton, Rani Chor.
- Personal views; not those of Stanford University.

Context Setting

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The CATS model used by CARB evaluates the likely future transportation fuel mix incentivized under LCFS, by finding the least cost solution to meet fuel demand given a GHG constraint.

These can lead to incentives for alternative fuels that 1) have local impacts to EJ communities, 2) have questionable GHG reductions if assumptions regarding carbon intensities are inaccurate.

We modeled the impacts of two key requests as our "EJ Scenario"

1) End avoided methane crediting in 2024.

(CARB proposal is 2040)

2) Impose cap on biofuel crop feedstocks.

(CARB proposal is no cap)

Added Assumption: Spend banked credits

(CARB modeling maintains bank)

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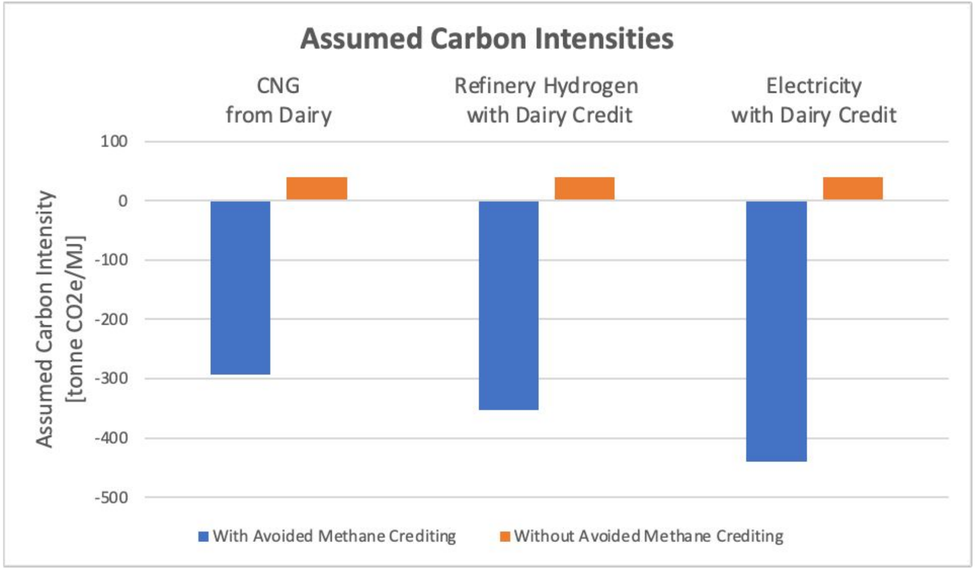
- We have focused on **model outputs through 2030** as most reliable.
- We found that CARB's assumptions used for scenario development **are out of date** in ways that significantly drive model results.
- We made a **preliminary update** to the energy demand assumptions to reflect current ARB policy and regulation. (Scoping Plan, ACC2, ACT, ACF)

Policy Adjustments - Avoided Methane Crediting

CARB's Preferred Scenario maintains avoided methane crediting through 2040.

EJ Scenario: Phase-out of avoided methane in 2024.

- Avoided methane crediting allows for capture of methane at dairies to be credited to fossil gas use at energy facilities like refineries.
- Subsidizes CAFOs and use of existing refinery capacity - not green H_2.

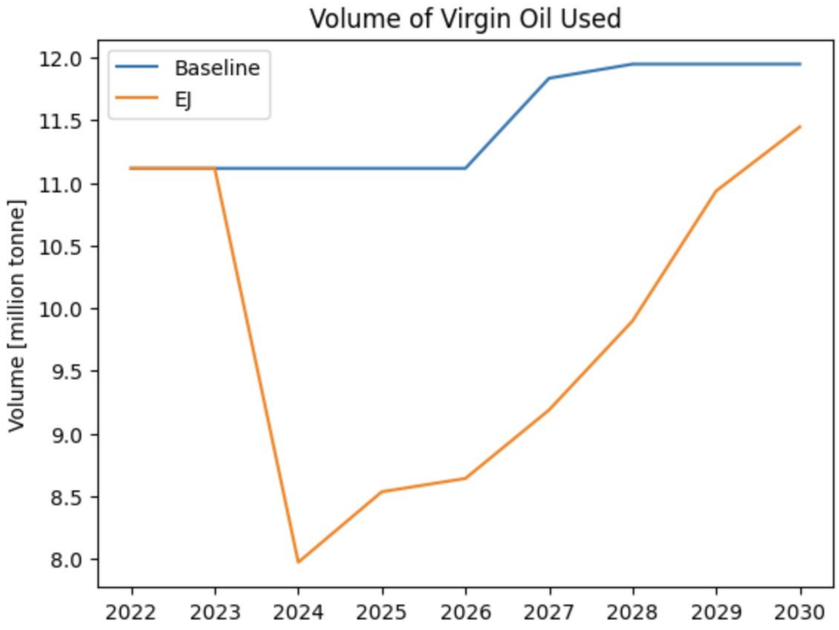


Policy Adjustments - Biofuel Feedstock Caps

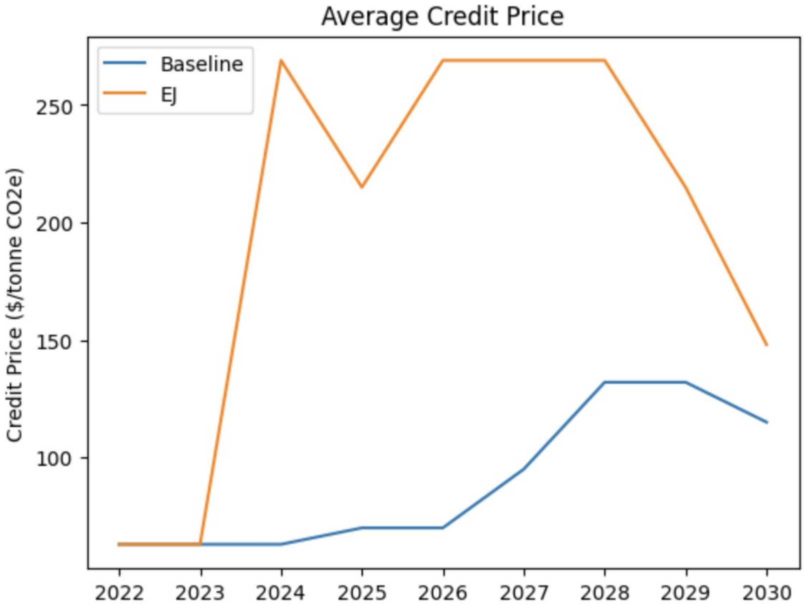
CARB's Preferred Scenario allows unlimited use of crop oils.

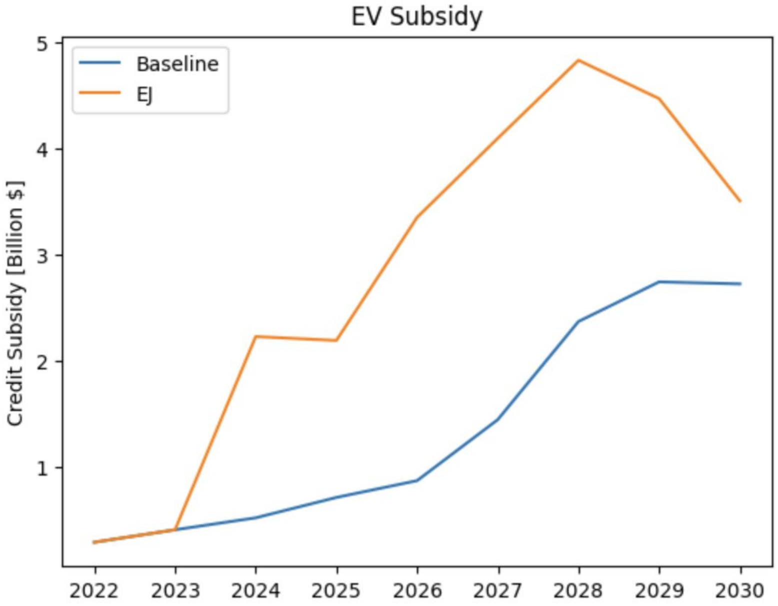
EJ Scenario: Cap crop oils at 1.2 million DGE [ICCT 2022].

- Additional **500,000 acres** of land needed under baseline compared to EJ.
- Marginal land for soy production often provided by destruction of Amazonian rainforest.
- ARB is not updating ILUC as part of this rulemaking.



Key Finding #1: EJ Scenario is Reasonable and Consistent with CARB Priorities



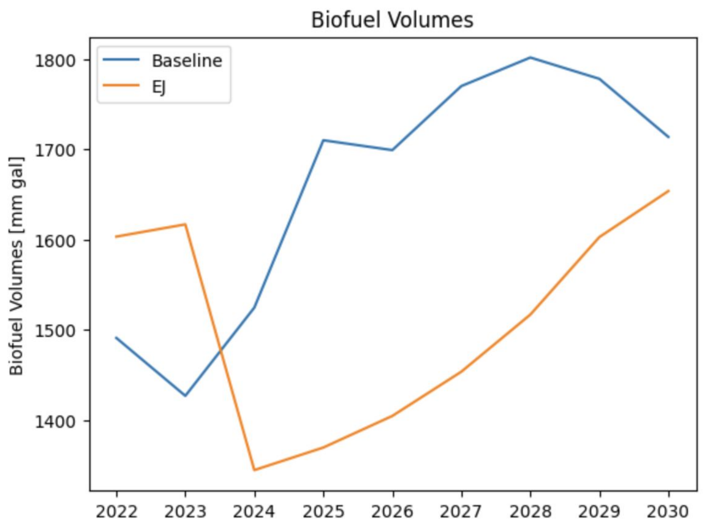


- Average Baseline Credit Price until 2030: **$89**.
- Average EJ Credit Price until 2030: **$198**.
- Banking of credits stabilizes credit price.

- Total Baseline EV Subsidy until 2030: **$15 billion**.
- Total EJ EV Subsidy until 2030: **$34 billion**.
- Faster and greater support for CARB EV policies

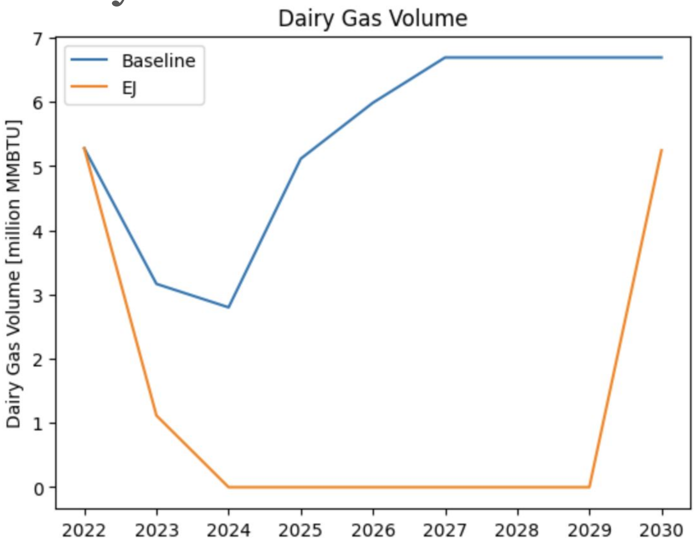
Key Finding #2: EJ Scenario Reduces Local Impacts

Refinery



- **1350 million gallons** less biofuel produced by 2030 under EJ scenario.
- Reduced refinery air pollution.

Dairy Gas



- Total Baseline Dairy Gas until 2030: **49 million MMBTU**.
- Total EJ Dairy Gas until 2030: **12 million MMBTU**.

Key Finding #3: EJ Scenario Avoids Unintended Impacts

- Avoids land conversion emissions (forest->farm) for crop-based fuels.
- Reduces use of liquid biofuels that emit local air pollutants in EJ communities.
- Reduces use of hydrogen produced at existing steam methane reformers that emit local air pollutants.
- Focuses LCFS subsidy in areas most likely to produce long-run transformation of transportation sector including electrification and electrolytic hydrogen (green H_2).

Key Finding #4: Consumer costs will matter by 2030 and should be carefully considered relative to benefits of program

- By 2030, ~¼ of LDVs are EVs under CARB planning scenarios.
- Mostly these will be new cars sold to more affluent consumers.
- LCFS is passed through to gas purchasers.
- Current cost of LCFS in gas price is ~$0.10/g
- If credit price was $200 today, cost of LCFS in gas price would be ~$0.26/g
- Credit prices MUCH HIGHER by 2030, especially if ARB increases stringency.

Key Finding #4: Consumer costs will matter by 2030 and should be carefully considered relative to benefits of program

Costs per gallon at the pump of current and future LCFS policies

	CI reduction	$80/ton (current)	$100/ton	$200/ton
2023	-11.25	$0.10	$0.13	$0.26
2030	-20	$0.18	$0.23	$0.46
2030	-30	$0.25	$0.34	$0.69

Key Finding #5: ARB needs to dramatically improve measurement of methane emissions from agriculture

- SB 1383 sets goal of reducing methane emissions by 40% by 2030.
- ~55% of methane emissions come from agriculture (ARB, 2022).
- How do we know what these emissions are?
  a. USDA estimate of number of cows once every 5 years.
  b. 2005 personal communication with US EPA re manure management at CAFOs and consequent CH_4 emissions per head.

Key Finding #5: ARB urgently needs to dramatically improve measurement of methane emissions from agriculture

- Without data, ARB and other stakeholders **will have no reliable basis** for judging compliance with SB1383 goal (40% reduction).
- ARB needs (monthly? annual?) farm level data from every CAFO and feed lot regarding:
  a. Herd size, type, age, feed type
  b. Manure management practice(s)
- With emissions factor data and better emissions estimates, regulatory options may come into focus for ARB and stakeholders.

Conclusions

- Update of assumptions to reflect rapidly changing regulations and EV adoption is critical to LCFS planning.
- Stanford modeling suggests EJ scenario could achieve ARB goals while lowering impacts to EJ communities and potentially improving climate outcome.
- LCFS is a subsidy paid for by California gas purchasers. Need to evaluate internal market dynamics in terms of impacts on low and moderate income households
- We can't improve what we don't measure. Urgent need to better measure methane emissions in agricultural operations for SB 1383 goals.

Appendix: Modeling Assumptions

- CARB's provided scenario does not take into account ACF, ACC 2, ACT.
    - We incorporate the impacts of these pieces of legislation into our model by updating the energy demands
        - We assume energy demands increases for electricity, hydrogen and decreases for gasoline, diesel.
            - 50% interpolation between CARB's provided energy demands and scoping plan energy demands.
- EJ Modifications:
    - Cap biofuels + renewable diesel supply at 1.2 DGE.
    - Change dairy gas CI from to 40 tonne CO_2e/MJ
- In EJ scenario, we assume currently banked credits (~16 million tonnes) will be spent in the years when the credit price is most expensive.

Acknowledgement and Disclaimers

Neither the [practicum/Climate Center], nor any other part of Stanford take a formal position in favor or opposed to specific program design elements. Any errors or opinions expressed are solely those of the [team].