November 12, 2025

Lauren Sanchez
Chair, California Air Resource Board
1001 I Street
Sacramento, CA 95814

RE: Environmental Defense Fund Comments on October 29, 2025 Cap-and-Invest Workshop

Dear Chair Sanchez,

On behalf of Environmental Defense Fund (EDF), we appreciate the opportunity to provide comments responding to the October 29, 2025, workshop on updates to the California Cap-and-Invest Program. EDF appreciates CARB's work on this important program and we look forward to continued engagement through the formal rulemaking process.

CARB's workshop follows crucial action by the Legislature and the Governor to pass and sign into law AB 1207, extending California's globally leading Cap-and-Invest Program through at least 2045. The legislation requires CARB to adopt Cap-and-Invest rules that ensure emissions covered by the Program decline, at a minimum, in line with California's 2030 and 2045 climate targets[1] – reaffirming the importance of calibrating the Program's emissions cap to act as a backstop. The legislation also rightly recognizes the affordability benefits of Cap-and-Invest and places increased emphasis on evaluating and enhancing those benefits over time.

California's leadership on cutting emissions and cutting costs is more important than ever. Devastating climate change-fueled damages continue to mount, with the cost of climate disasters in California estimated at $100-200 billion between 2014 and 2024.[2] At the same time, the U.S. federal government has stepped back in its efforts to address climate change and has introduced uncertainty around key policies for California to protect clean air and human health, such as the Advanced Clean Cars II and Advanced Clean Trucks rules. Sharply rising electricity costs and other consumer prices – driven by costly wildfires and other climate change-fueled disasters, ongoing supply chain challenges, increased electricity demand, and tariffs – are making it more difficult for Californians to afford day-to-day needs like energy.

[1] Section 38562(c)(2) of the Health and Safety Code
[2] https://claimguide.org/disaster-preparedness/

Cap and Invest is California's most cost-effective tool to reduce greenhouse gas emissions; the state can and should lean further on this critical program to achieve its climate targets, cost-effectively and affordably. In this moment of rising climate impacts, affordability concerns and federal backsliding, **it is more important than ever for CARB to strengthen California's marquee climate program – Cap and Invest – and to amplify its leadership by pursuing additional carbon market linkage partnerships with states like Washington.**

EDF deeply appreciates CARB outlining an ambitious timeline to finalize rule updates. Finalizing key program updates early in the coming year will facilitate a long-term investment signal to support clean energy and pollution abatement and will strengthen the foundation for California to step up its leadership through expanded partnership with other states. **EDF strongly supports CARB moving swiftly through the formal rulemaking process to ensure Program updates are in effect no later than late 2026**, with reductions to the allowance budget implemented beginning no later than 2027.

Strengthening Emissions Pathways to Support Affordability and Climate Ambition

CARB's proposed allowance budget reductions help ensure alignment of the Cap-and-Invest Program with California's climate targets. EDF strongly supports this direction and appreciates CARB's presentation of a 118 million metric ton reduction as the **minimum** necessary to meet the state's statutory requirements. However, as CARB staff emphasized during the workshop, "we have to act on the science," and CARB can and should go further to increase the ambition of the program's 2027-2030 allowance budgets to drive deeper emissions reductions this decade.

We appreciate CARB's focus on affordability and efforts to minimize consumer impacts. Modeling and program data continue to demonstrate that the Cap-and-Invest Program is already helping to improve affordability for Californians by reducing household costs through clean energy investments and by returning value to customers[3]. **New modeling shows that more ambitious allowance budget cuts beyond the minimum 118 million metric ton reduction can drive deeper emission reductions while maintaining consumer affordability.**

New analysis from Greenline Insights, attached as an appendix to these comments, shows that higher ambition is achievable and affordable. For example, Greenline Insights modeled a "Higher Ambition" scenario that removes 154.3 million allowances between 2027 and 2030 and a cap that declines linearly from 2030 to 2045 – delivering greater cumulative emissions reductions *while also providing net savings for households earning $100,000 or less annually – 54% of California families*. This higher ambition scenario accelerates allowance removals, achieves a linear, incremental reduction in the annual allowance budget post-2030 with no cap plateaus or increases, and results in 255-586 million fewer emissions allowances compared to the Moderate Ambition or Lower Ambition Scenarios.

[3] https://www.greenlineinsights.com/investments-for-californias-future

While this scenario is dramatically less ambitious in the near term than the initial 48% reduction aligned-scenario presented by CARB in earlier workshops, the Greenline Insights analysis demonstrates that ambition beyond the bare minimum 118 million allowances removed would still maintain market stability and would deliver a steadily increasing but modest price signal, in addition to being essential for near-term climate mitigation. The “Higher Ambition” scenario, importantly, avoids hitting price containment points, representing a steady price trajectory well within the cost containment features built into the program.

Should CARB decide to pursue the “bare minimum” scenario by reducing near-term allowance supply by only 118 million allowances, there is still a decision point between more and less climate ambition. By decreasing allowance budgets linearly from 2027-2030 relative to current regulation, CARB can remove 118 million allowances pre-2030 while reaching an allowance budget of 153.2 $MMTCO_2e$ in 2030. This linear approach would deliver greater cumulative reductions than a version of the 118 million scenario that results in an allowance “plateau” pre-2030, also outlined in Greenline’s modeling, and establish a stronger foundation for post-2030 ambition. Greeline’s modeling demonstrates that a linear, declining cap for removing 118 million allowances – the Moderate Ambition Scenario – provides a stronger price signal compared to the Lower Ambition Scenario, which tracks closely with the price floor through 2045 and may result in undersubscribed auctions as early as 2038. While the improved design through the Moderate Ambition Scenario would still fall short of the deeper reductions achieved under the Higher Ambition 154.3 million pathway, it demonstrates that CARB has options to enhance environmental outcomes even within a “bare minimum” scenario.

We appreciate that CARB is prioritizing removal of the allowances from auction supply instead of other options, which ensures that the reductions represented by the removal of these allowances are real. Nonetheless, the current proposal reflects a notable decline in ambition compared to where discussions stood a year ago - when CARB modeled scenarios removing up to 265 million allowances to align with the 48% emission reduction below the 1990 level which is necessary to put California on track to achieve the 2045 net zero target. The urgency of cutting climate pollution cannot be overstated: early reductions yield greater cumulative emissions reductions, and cumulative emissions are ultimately what determine climate outcomes. To deliver on the state’s 2030 and 2045 goals while prioritizing consumer outcomes, CARB should pursue a budget reduction scenario that achieves more than the bare minimum. **A 154.3 million, “Higher Ambition” scenario would accelerate near-term reductions, minimize cumulative emissions, balance cost concerns, and secure a safer, more affordable climate future for Californians.**

Strategies to Address Affordability, Cost Containment, and Emissions Leakage

California Climate Credit

The California Climate Credit is one of the most important ways households see the affordability benefits of the Cap-and-Invest Program. Since 2014, households have received over $16 billion

in credits on their electric and natural gas utility bills,[4] providing important bill savings to households and helping to offset rising electricity costs. The California Climate Credit has been a critical source of relief on utility bills, particularly for low- and moderate-income households, and plays an important role in demonstrating to Californians how climate policy is working to both cut emissions and support affordability.

The Cap-and-Invest rulemaking at CARB and the California Public Utilities Commission (PUC) rulemaking to update the California Climate Credit present important opportunities to enhance these affordability benefits. The Cap-and-Invest regulation determines how much of the program's allowance value is allocated to utilities and broadly how the revenue from that allocation may be used, while the CPUC rules determine the specifics around how utilities use, distribute, and communicate the benefits of allowance revenue to customers. **As CARB considers changes to utility allowance allocation, EDF encourages CARB to make household affordability the guiding principle and maximize the Cap-and-Invest Program's impact on reducing household electricity bills**. EDF encourages CARB to consider the following opportunities to enhance the Cap-and-Invest Program's affordability benefits on electric bills:

- As the overall program allowance budget is reduced in line with the state's climate targets, it will be important to ensure that allowance allocation to electric utilities (both in terms of quantity and allowable uses of the revenue) are calibrated such that the program continues to protect utility customers and prioritizes household affordability benefits.
- One tangible opportunity available for CARB to unlock greater affordability benefits is to update the Cap-and-Invest regulation to allow for volumetric credits to ratepayers. Currently, the regulation bars utilities from returning allowance proceeds to ratepayers in a volumetric manner. Removing this prohibition would allow utilities to use Cap-and-Invest proceeds to directly reduce electric rates, which in turn will help households power their cooling, heating, cooking, and transportation with more affordable electricity.
- CARB should make as much progress as possible in this rulemaking to implement the transition from natural gas to electric utility allocation as required by AB 1207.[5] This transition will help make it more affordable for California families to electrify their homes and transportation.

Industrial Allowance Allocation

California's output-based allocation (OBA) method has a strong track record of cutting climate pollution from emissions-intensive industries while supporting in-state industrial and manufacturing activity. OBA ensures that industrial facilities are rewarded based on two key metrics: 1) how much they produce in-state, and 2) how efficiently they produce compared to similar industrial facilities. As presented in the October 29th workshop, CARB's forthcoming

[4] https://www.cpuc.ca.gov/industries-and-topics/natural-gas/greenhouse-gas-cap-and-trade-program
[5] See Section 38562(b)(1)(B)(i) of the Health and Safety Code

study demonstrates that OBA has been effective at addressing emissions leakage risk in emissions-intensive trade-exposed (EITE) industries.

CARB should retain this proven method for preventing industrial leakage and ensure the factors that go into the OBA formula – leakage assistance factors, greenhouse gas benchmarks, and the cap decline factor – are grounded in real economic data on leakage risk and best-in-class industry standards. As CARB moves forward to tighten the program-wide emissions cap, EDF supports CARB adopting a new cap decline factor in proportion to the tighter program emissions cap. Updating the cap decline factor in line with the program's steadily declining cap will help send an increasing price signal that stimulates decarbonization investments. Adjusting the cap decline factor to be up-to-date, in proportion to the program's overall cap, may also be important to ensuring other critical allowance allocations in the program (e.g. to benefit electric utility customers) can be maintained and enhanced.

In the October 29 workshop, CARB presented a concept for revising industrial allowance allocation to direct funds towards specific decarbonization projects. For the purposes of this rulemaking, EDF urges CARB to focus on high-priority items that must be addressed in the near term to align the Cap-and-Invest Program with the state's climate targets. Updates to the pre-2030 emissions cap are particularly urgent given the cumulative impact of greenhouse gas emissions and the limited time available between now and 2030 to calibrate the emissions cap to the state's 2030 climate goals; EDF is concerned that consideration of new methods for industrial allowance allocation will cause further delay, which is especially unnecessary given the successful track record of the existing system. Therefore, EDF urges CARB to retain OBA and focus on bringing the OBA factors up to date in this rulemaking rather than considering changes to the allocation method.

Cost Containment

EDF encourages CARB to implement a tighter cap via removing allowances from direct allocation and auction pools, rather than from alternatives such as the Allowance Price Containment Reserve (APCR). The APCR is a key feature of the program to protect against price volatility and help stabilize prices in the case of unusually high demand. In the workshop, CARB outlined a proposal excluding removal of allowances from the APCR or Price Ceiling accounts.[6] EDF supports CARB pursuing this approach to draw the necessary allowance reductions from direct allocation and the auction supply, while maintaining the integrity of the APCR – a central feature for how the program contains costs over time.

Ensuring Cap Integrity Through Legislative Implementation

Cap Integrity & Use of Price Ceiling Revenue

[6] See slide 19:
https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/meetings/nc_CapInvestWorkshop_October2925.pdf

As CARB considers updates to the Cap-and-Invest Program, maintaining the environmental integrity of the cap must remain a central priority. The program's credibility and its ability to ensure California meets its climate goals depends on the certainty that total emissions remain within the statutory limits the state has set. The central strength of the Cap-and-Invest Program is that it provides a firm, declining backstop on climate pollution. This backstop ensures that total emissions remain within the boundaries California has committed to, even if other policies fall short, cannot be fully implemented, or take longer to achieve their intended reductions. That cap integrity is threatened, however, if the design of the program's price ceiling allows for unlimited issuance of compliance instruments without ensuring equivalent emissions reductions.

Prior to the 2025 program reauthorization, revenue from the sale of price ceiling units (PCUs) was required to be used to purchase at least an equivalent ton-for-ton quantity of emissions reductions. This provided an essential safeguard to preserve the integrity of the cap, even in an instance where PCUs are issued. With the passage of AB 1207, that ton-for-ton requirement was replaced with a directive to use PCU revenue for consumer rebates. Supporting affordability is a goal that EDF shares, but this change has the potential to leave a massive gap in California's pollution cap.

Moving forward, **CARB should identify an approach for the use of PCU revenue that protects affordability in line with Legislative direction in AB 1207 and preserves the integrity of the emissions cap.** There are multiple options CARB could pursue to achieve both outcomes, including structuring rebates and incentives to also achieve measurable emissions reductions from vehicle electrification or building decarbonization or dedicating a portion of PCU revenue to securing verified reductions, with remaining funds distributed as direct consumer rebates.

While CARB may not have the authority to create or manage funds, it is essential to establish regulations which maintain the integrity of the cap so California's world-leading Cap-and-Invest Program remains a model for other jurisdictions. A gap in the cap is not an example to partners California may desire to link with in the future.

Treatment of Offsets

EDF supports CARB's implementation of the AB 1207 direction to remove allowances from the budget equal to the number of offsets used for compliance. This approach should alleviate concerns from some about the environmental integrity of offsets in the Program as it acts as an additional "insurance policy" against offset reversals. This measure also represents a modest increase in Program ambition, which is welcome as we seek to maximize emission reductions. We appreciate CARB's efforts to design this transition thoughtfully and encourage the agency to prioritize the smooth implementation of allowance removals to provide market certainty and revenue stability.

While this adjustment represents a modest tightening of the cap in the near term, these removals do not substitute for an increase in long term ambition. Offsets remain an important

tool for delivering cost-effective reductions outside of the capped sectors in this Program and represent a crucial revenue stream for Tribal communities and investments in natural and working lands while supporting ecosystem restoration and community co-benefits.

Advancing Ambition and Affordability Together

California's Cap-and-Invest Program remains one of the state's most powerful tools to deliver on its commitments, and the urgency to act has never been greater. As CARB underscored in their October 29 presentation, the costs of inaction are already immense: California faces the highest climate-related disaster losses in the nation, averaging more than $16 billion annually. Home insurance is becoming harder and more expensive to obtain, and Californians are bearing mounting costs from extreme heat, floods, and wildfires. Over the past decade alone, major heat events caused $7.7 billion in losses, and wildfire smoke exposure has contributed to more than 50,000 deaths and an estimated $400 billion in economic damages. These figures make it painfully clear that **failing to cut pollution quickly enough to prevent escalating climate impacts is itself an affordability crisis.**

As CARB moves forward, we encourage the Board to adopt updated, ambitious regulations to ensure a durable and effective program. A thorough and efficient implementation of this rulemaking will enable CARB to take up a linkage rulemaking with Washington with all possible timeliness - an essential step to strengthen market stability and enhance the collective impact of cap-and-invest programs across jurisdictions.

As aptly noted in the October 29 workshop by commenter Doug Karpa of Peninsula Clean Energy, "if the social cost of climate impacts is higher than the allowance or compliance cost, that's not an affordability solution." Ambition and affordability are not competing goals - they are essential and achievable in tandem. By strengthening the Cap-and-Invest Program now, CARB can protect Californians from the growing costs of climate change, ensure a more equitable and affordable clean energy transition, and reaffirm the state's leadership in building a safe, resilient, and prosperous future.

Caroline Jones
Manager, Energy Transition & Carbon Markets

Katie Schneer
Manager, Clean Electricity & Carbon Markets

Katelyn Roedner Sutter
Senior Director, California

Greenline Insights

ISSUE BRIEF

Analytical Response to CARB's October 29, 2025 Cap-and-Invest Workshop

November 12, 2025

Jonah Kurman-Faber, George Rakushkin, Ashna Aggarwal

Summary

This analysis provides a technical review of California Air Resources Board (CARB)'s proposed cap-and-invest program adjustments discussed in the October 29th workshop. Using Greenline Insights' TRACE model, we evaluate two interpretations of CARB's proposed removal of 118.3 million allowances between 2027 and 2030, each tested under two emissions demand pathways. We test a third higher-ambition cap scenario with greater allowance removals, to assess the resulting allowance price pathway and economic impacts. Together, these scenarios illustrate a range of potential market outcomes under varying levels of allowance supply and demand.

Modeling results indicate that each cap trajectory results in a different market balance. A lower ambition pathway is projected to result in a substantial volume of unused allowances through 2045, resulting in undersubscribed auctions as soon as 2038 and allowance prices at the floor for the majority of the program. Both the moderate- and higher-ambition cap scenarios result in improved market balance across multiple emissions scenarios while remaining within price containment parameters.

Across all modeled scenarios, household-level effects remain modest and progressively distributed. Households earning below $70,000 per year experience net average benefits in every case, while middle-income impacts remain cost-neutral or negligible through 2045. These results reflect differences in household energy use and spending by income level, combined with the redistributive effects of climate dividends and Greenhouse Gas Reduction Fund (GGRF) investments. Industrial assistance is also found to yield indirect household benefits, with roughly one-fifth of the associated value of free allowances passed through to in-state consumers.

About Greenline Insights

Greenline Insights is an independent, nonpartisan research firm specializing in advanced energy and economic modeling to inform effective policy design and actionable strategies. Our work spans climate and energy, industrial decarbonization, innovation, infrastructure, advanced manufacturing, and supply chain analysis – supported by custom datasets, modeling workflows, and data tools built for each project's unique analytical needs.

California TRACE (Tool for Regional Analysis of Cap-and-Invest Economics) is a two-stage modeling framework that links allowance market dynamics and detailed economic distributional outcomes from California's cap-and-invest program. California TRACE is built to evaluate "what-if" policy designs transparently: it projects annual allowance prices and quantities under alternative cap, offset, and reserve settings, then traces how compliance costs and allowance value flow through utilities, industries, and ultimately California households by income bracket.

California TRACE was developed by Greenline Insights, with support and partnership from Environmental Defense Fund. All methodologies, results, and commentary in this memo are the opinion of Greenline Insights and do not reflect the opinions of supporters or partners.

Overview of Modeling Scenarios

As detailed in their recent workshop, CARB proposes a removal of 118.3 million allowances from future allowance budgets. This is intended purely as a GHG accounting adjustment, to be enacted in 2027-2030 budget years. After 2030, CARB intends to maintain a *"smooth decline from 2030 budget to 2045 budget, including gradual removal of additional allowances aligned with cumulative budgets analyzed in prior workshops."*[1]

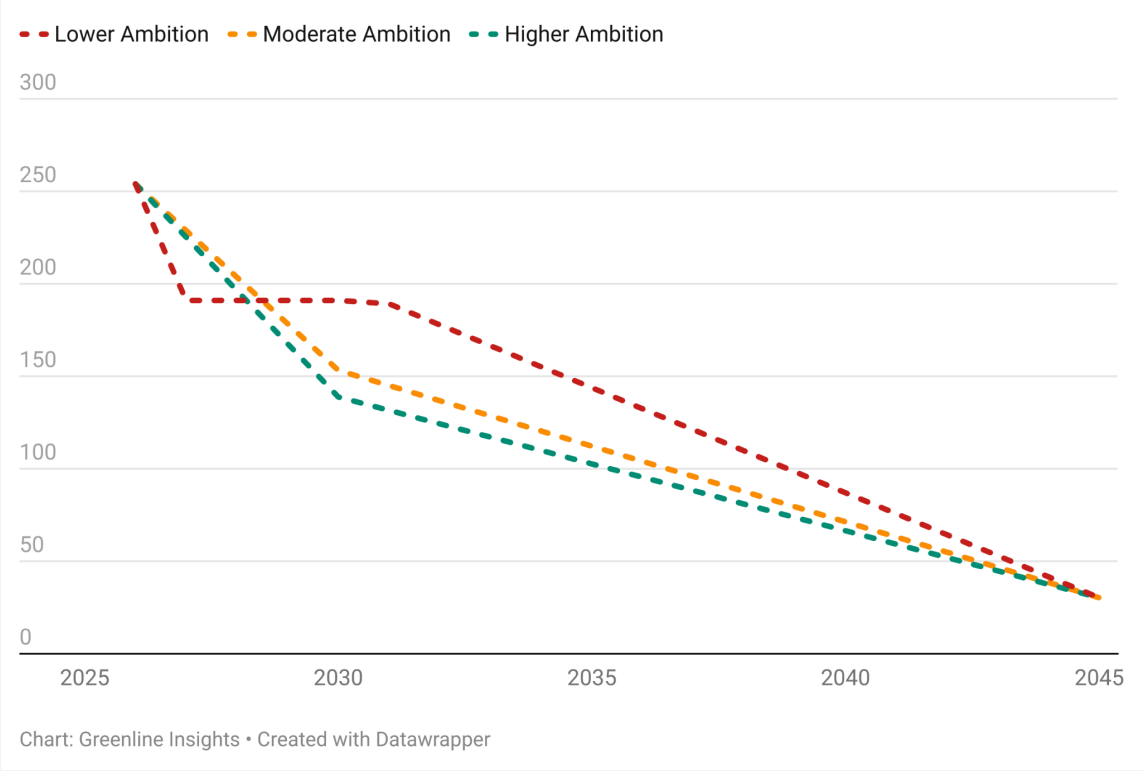
We have constructed three cap trajectories to test in the TRACE model, two of which align with CARB's language provided in the workshop. A third scenario illustrates a cap trajectory with higher program ambition. All three scenarios differ in their cumulative allowance budgets through 2045, as well as their trajectory between 2026 and 2030.

[1] California Air Resources Board, Cap-and-Invest Program Workshop, October 29, 2025.

Table 1. Explanation of Modeled Cap Trajectories

Cap Scenario	Description
Lower Ambition Scenario	118.3 million allowances are removed from current regulatory budgets between 2027 and 2030 (creating a "plateau" shape). Between 2031 and 2045, the cap declines linearly from the 2030 budget under current regulations (200.5 $MMTCO_2e$) to an 85% reduction budget in 2045 (30.3 $MMTCO_2e$).
Moderate Ambition Scenario	Between 2027 and 2030, allowance budgets decrease linearly each year relative to current regulation (-11.8 $MMTCO_2e$ in 2027, up to -47.3 $MMTCO_2e$ in 2030). This results in an allowance budget of 153.2 $MMTCO_2e$ in 2030, with 118.3 million in cumulative removals through 2030. Between 2031 and 2045, the cap declines linearly from the 2030 allowance budget to 30.3 $MMTCO_2e$.
Higher Ambition Scenario	This alternative cap scenario removes 154.3 million allowances between 2027 and 2030, decreasing linearly to an allowance budget of 138.8 $MMTCO_2e$ in 2030. This 2030 budget aligns with Proposed Scenario A from the SRIA. Between 2031 and 2045, the cap declines linearly from this 2030 allowance budget to 30.3 $MMTCO_2e$ in 2045.

Figure 1. Modeled Cap Trajectories, $MMTCO_2e$



The Lower and Moderate Ambition scenarios remove the same quantity of allowances from the 2027-2030 period, offering different interpretations of the 118.3 million allowances of removal suggested by CARB. The Higher Ambition Scenario offers an alternative with accelerated removals in the short term, resulting in a lower cumulative supply through 2045.

Table 1. Cumulative Allowance Budgets Under Cap Scenarios

Cap Trajectory	Cumulative Allowance Budget, 2026 - 2045[2]
Lower Ambition Scenario	2,664 $MMTCO_2e$
Moderate Ambition Scenario	2,333 $MMTCO_2e$
Higher Ambition Scenario	2,196 $MMTCO_2e$

All three cap scenarios were simulated in the TRACE model, which forecasts allowance market behavior and resulting net economic impacts by household income and industry. We developed forecasts for allowance price pathways by simulating how each of the three cap trajectories interacts with two emissions demand scenarios, which are described below:

A. **Scoping Plan Emissions -** This trajectory mirrors the projected cap-and-invest covered emissions described as "Proposed Scenarios" in CARB's Standardized Regulatory Impact Assessment (SRIA) released in 2024. This scenario serves as an approximate representation of the expected emissions outcome for California with full and successful implementation of the 2022 Scoping Plan.

B. **Midpoint Emissions -** This emissions scenario represents continued policy ambition in California, with certain key missing policy parameters that differentiate from the Scoping Plan Emissions scenario (such as a potential loss of waivers, or a moderately ambitious cap-and-invest program). As a result, the state achieves emissions reductions that are halfway between Scoping Plan Emissions and the "Baseline" established in the 2024 SRIA.

The relative probability of any emissions scenario occurring is outside the scope of this model. However, the likelihood of a Scoping Plan Emissions scenario increases with greater ambition from the cap-and-invest program.

[2] These figures are considered initial values in the model. Final model results account for changes in supply due to APCR triggers, private bank use, and future budget adjustments due to offsets.

Lower Ambition Scenario

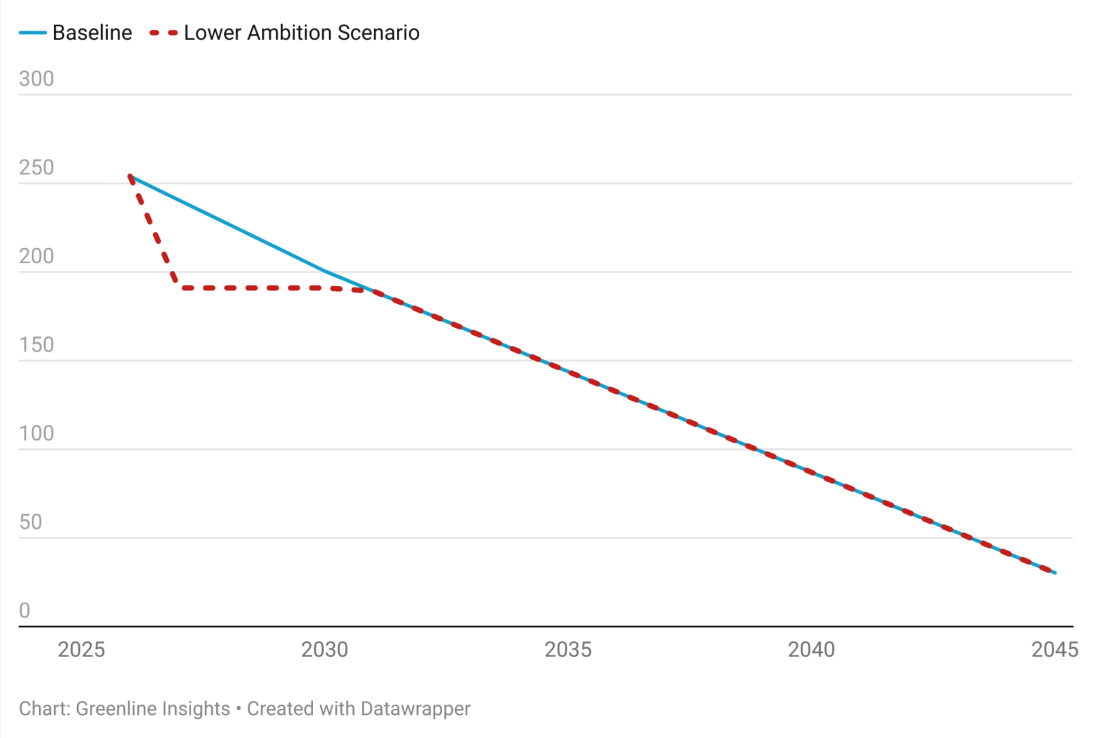
In the Lower Ambition Scenario, 118.3 million allowances are removed between 2027 and 2030, in a schedule resembling a plateau, after which the cap declines linearly from 189.2 million allowances in 2031 to 30.3 million allowances in 2045.

Between 2026 and 2045, this scenario contains a cumulative allowance supply of 2,664 $MMTCO_2e$. Compared to formerly proposed cap trajectories in the SRIA, this is:

- **+161 $MMTCO_2e$** higher than cumulative supply of the "Simple Target" scenario.
- Approximately **+320 $MMTCO_2e$** higher than the cumulative supply of SRIA Proposed Scenarios (Proposed Scenario A, Smoothed Option 1, Smoothed Option 2).

A comparative Baseline cap trajectory is visualized below, representing current regulations and a cap trajectory aligned with 85% below 1990 levels by 2045 in the post-2030 era:[3]

Figure 2. Cap Trajectory Under a Lower-Ambition Scenario, $MMTCO_2e$



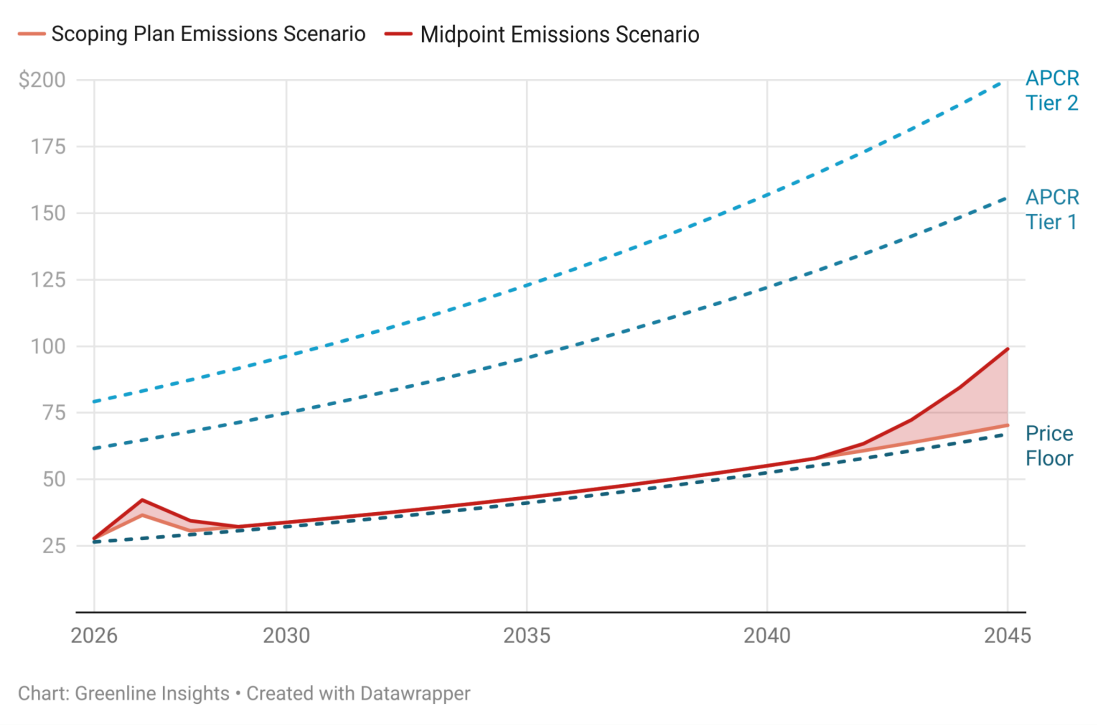
[3] CARB has not presented the "Baseline" scenario as a potential cap trajectory. It is presented here purely to illustrate the schedule of allowance removals under the Lower Ambition Scenario..

TRACE modeling suggests that this cap trajectory results in a large pool of excess allowances remaining in 2045. A Midpoint Emissions Scenario, which represents moderately successful policy conditions but not full Scoping Plan alignment, results in **over 150 million allowances in excess of demand by 2045**.

A Scoping Plan-aligned emissions scenario (as projected in the SRIA) would result in **over 500 million allowances in excess of demand by 2045**. Absent further cap adjustments, state auctions could become undersubscribed as soon as 2038, as the accumulated private allowance bank would sufficiently cover all remaining compliance obligations.

In both emissions scenarios, allowance prices under the Lower Ambition Scenario remain on the floor for the majority of the program. Note that the TRACE model simulates allowance markets on a year-by-year basis, resulting in allowance prices that may, in reality, be smoothed out by forward-looking speculative behavior.[4]

Figure 3. Allowance Price Pathways Under a Lower Ambition Scenario, $/MTCO$_2$e

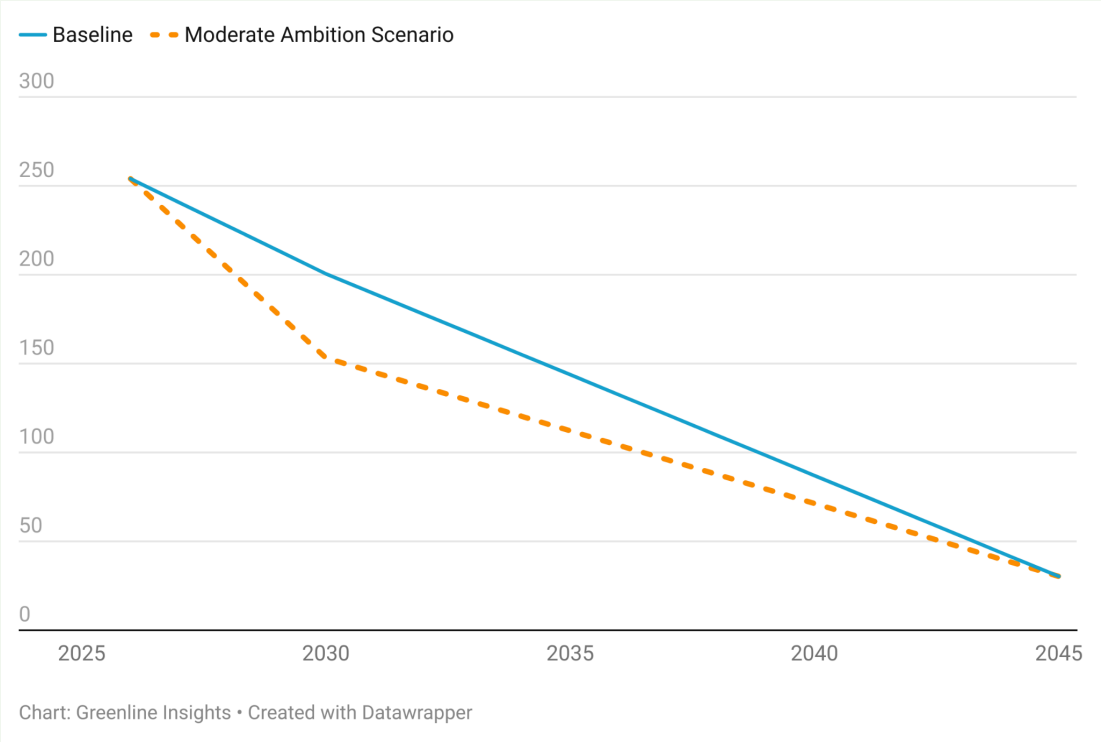


[4] Price trajectory outputs from the TRACE model are also available in smoother, post-processed forms such as a Hotelling path and logarithmic best-fit lines. Each of these approaches represent different economic theories on real-world market speculation and behavior. For transparency, this memo presents TRACE model outputs in their raw form to detect price floor settlement and acute APCR trigger events.

Moderate Ambition Scenario

Like the Lower-Ambition Scenario, the Moderate Ambition Scenario removes 118.3 million allowances from cumulative allowance supply between 2027 and 2030. However, this scenario then holds the annual budget at a new low of 153.2 $MMTCO_2e$ in 2030, and declines linearly to 30.3 allowances in 2045. This budget possesses a similar 2026-2045 cumulative supply to Proposed Scenario A, Smoothed Option 1, and Smoothed Option 2 established by CARB in the 2024 SRIA and following workshops.[5]

Figure 4. Cap Trajectory Under a Moderate Ambition Scenario, $MMTCO_2e$



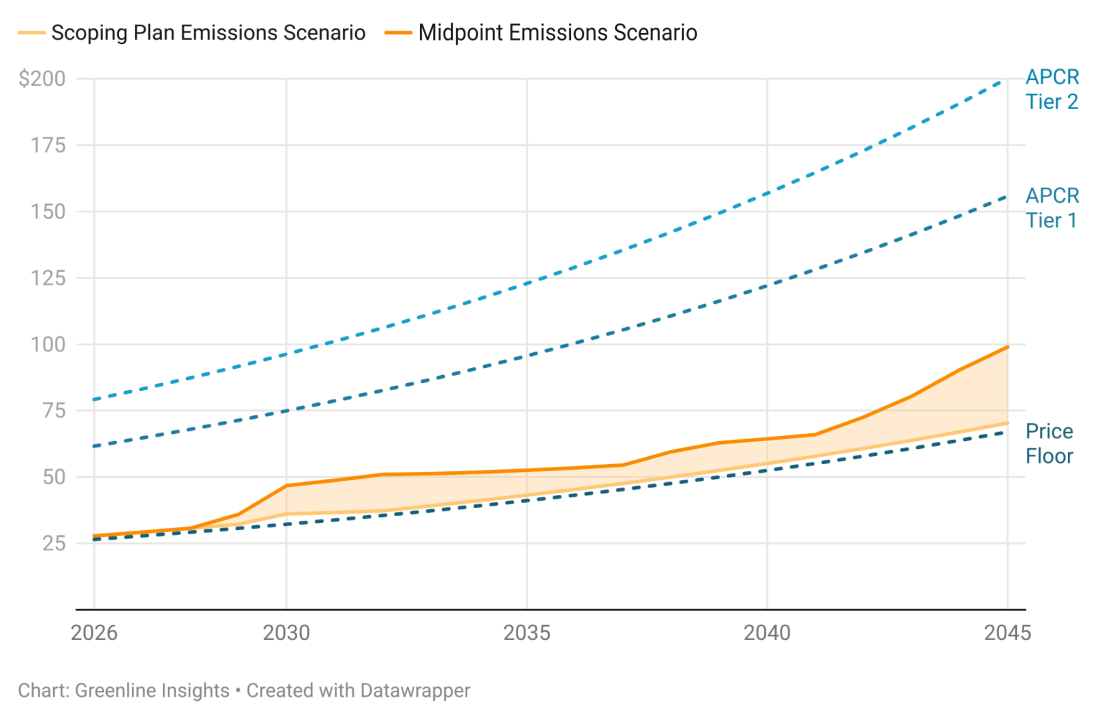
Modeling results find that this cap trajectory results in different allowance price pathways under different emissions scenarios. Under a Scoping Plan Emissions scenario, approximately **200 million excess allowances** remain in the system through 2045, which leads to market undersubscription as soon as 2041. As a result, allowance prices remain at or near the floor for the majority of the program.

[5] Note that SRIA-derived cap trajectories have been slightly modified in this analysis, to reflect recent CARB indications that no cap adjustments will take place in 2026.

Under the Midpoint Emissions Scenario, which assumes California is unable to meet its full policy ambition outlined in the 2022 Scoping Plan, the Moderate Ambition Scenario remains within the program's ascribed floors and ceilings. Said differently, the Moderate Ambition Scenario can withstand a more pessimistic emissions trajectory than under the Scoping Plan Emissions Scenario.

In addition, the Moderate-Ambition Scenario provides a stronger price pathway compared to the Lower-Ambition Scenario, which may support stronger GGRF program revenues and avoid undersubscribed auctions. Results provided in Figure 5 below present a range of potential price outcomes under varying emissions scenarios.

Figure 5. Allowance Price Projections Under a Moderate Ambition Scenario, $/MTCO$_2$e



As noted in prior sections, price outputs from the TRACE model are provided in raw form, rather than post-processed into a Hotelling path or logarithmic best fit. Forward-looking speculation may cause real-world price paths to differ from TRACE outputs. Rather than an exact price prediction, TRACE model outputs are best used as a directional stress test to assess long-term market balance and the risk of APCR trigger events.

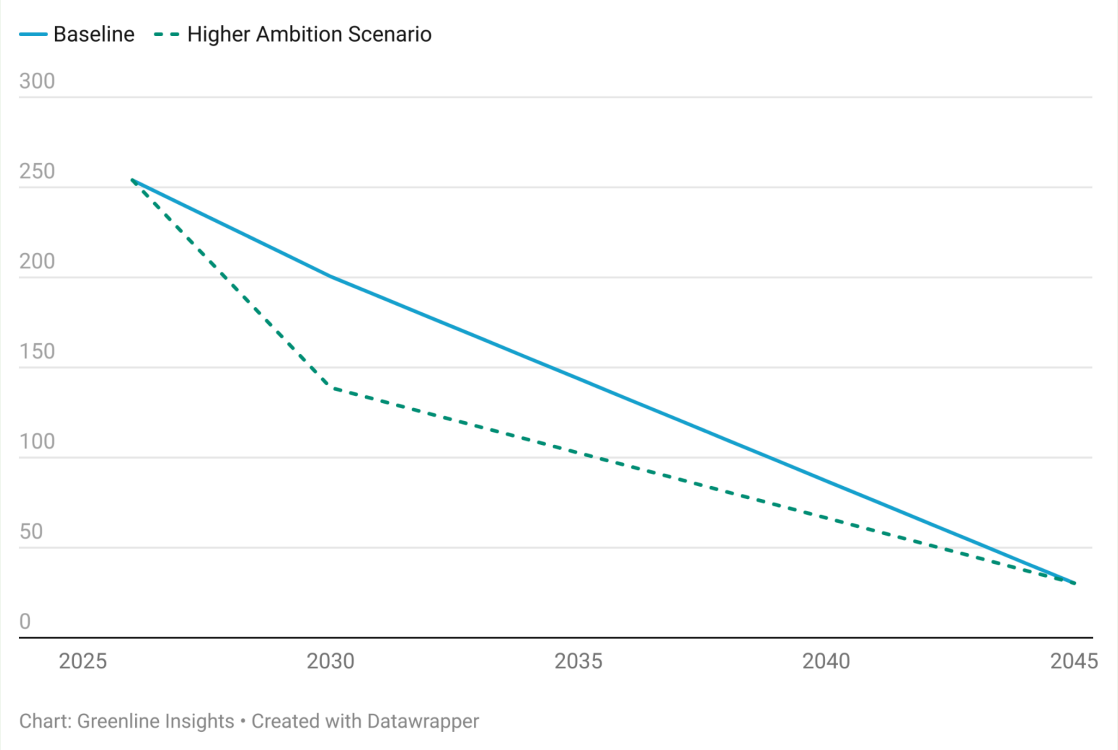
Higher Ambition Scenario

The Higher Ambition Scenario distinguishes itself from the other scenarios by providing greater removals from the cap trajectory than as suggested in CARB's October 29th workshop. This scenario was designed to achieve the following characteristics:

- Linear, incremental reductions in annual budget with no plateaus or increases
- Greater than 118.3 million allowances removed between 2027 and 2030
- A lower cumulative allowance supply than the Lower and Moderate Ambition Scenarios
- Sufficient allowance supply to maintain program stability and feasibility[6]

The resulting cap trajectory illustrated below removes 154.3 million allowances between 2027 and 2030, resulting in a 2030 annual budget of 138.8 $MMTCO_2e$, after which the cap declines linearly to 30.3 $MMTCO_2e$ in 2045.

Figure 6. Cap Trajectory Under a Higher-Ambition Scenario

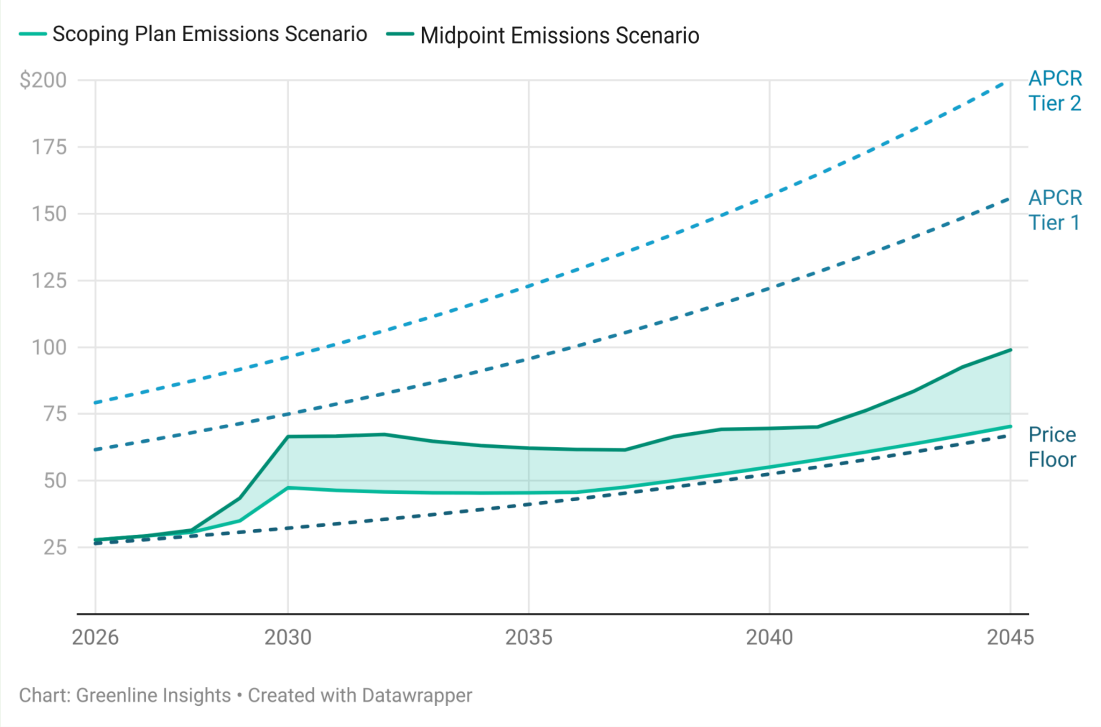


[6] While TRACE allows for rapid turnaround of new scenarios, it is not an optimization platform. The Higher Ambition Scenario does not present the only cap trajectory that satisfies these parameters, nor do we attempt to claim it is the single most optimal trajectory compared to all possible cap trajectories.

TRACE produces a larger spread of allowance price outcomes under this scenario, depending on emissions, that still remain within the APCR trigger boundaries. An optimistic Scoping Plan Emissions pathway results in 60 $MMTCO_2e$ in excess allowances remaining in 2045, resulting in a price pathway that lifts off the floor through 2035, before returning to the floor in the final ten years. The risk of auction undersubscription does not occur until the final 2 years of the program, where remaining private bank reserves may be sufficient to cover remaining compliance obligations.

A more pessimistic scenario with a Midpoint Emissions pathway results in greater price action, with the program staying above the floor from 2027 onwards, but remaining underneath APCR trigger prices for the duration of the program.

Figure 7. Allowance Price Projections Under a Higher Ambition Scenario, $/$MTCO_2e$



Across all scenarios, greater program ambition (expressed as an accelerated decline in the cap trajectory) leads to a wider range of potential prices. Under a Scoping Plan Emissions Scenario, all three cap trajectories lead to allowances prices near the floor for the majority of the program, with potential auction undersubscription in later years. Under a Midpoint Emissions Scenario, all cap trajectories remain within market bounds and avoid APCR triggers.

Net Household Impacts by Scenario

Household-level outcomes were assessed in the TRACE model to understand how different cap and emissions pathways affect Californians across income groups. Under all modeled scenarios, household impacts remain modest and progressively distributed, with lower-income households ($70k or less in annual income) consistently experiencing net benefits on average.

Table 2. Net Household Impacts by Scenario

Cap Scenario	Emissions Scenario	Household Impacts
Lower Ambition	**Scoping Plan Emissions**	Households earning $200k or less see an average annual benefit of $12, with the lowest-income households realizing benefits of up to $95 per year.
Lower Ambition	**Midpoint Emissions**	In the short-term (2026-2030), impacts are neutral for households earning $150k or less. Through 2045, households earning $100k or less see an average annual benefit of $13.
Moderate Ambition	**Scoping Plan Emissions**	Short-term effects are neutral for households earning $200k or less. Through 2045, households earning $100k or less see a modest benefit of $14 per year.
Moderate Ambition	**Midpoint Emissions**	Short-term effects are neutral for households earning $150k or less per year. Through 2045, households earning $70k or less remain net-positive, with up to $60 in annual benefits for the lowest-income households.
Higher Ambition	**Scoping Plan Emissions**	Short-term effects are neutral for households earning $150k or less per year. Through 2045, effects remain slightly positive for households earning $100k or less.
Higher Ambition	**Midpoint Emissions**	Short-term effects are net-positive for households earning $100k or less. Through 2045, households earning $70k or less remain nearly net-neutral, with up to $55 in yearly benefits for the lowest income households.

Across all cap and emissions scenarios, the distributional effects are progressive. Lower-income households experience greater proportional benefits due to differences in spending and energy consumption patterns, relative to higher income households. These estimates incorporate the direct and indirect effects of the program, including from energy cost increases, business cost pass-through, climate dividends, benefits pass-through from industrial and small business assistance, and cash rebates from GGRF programs directed at households.

Household benefits may be higher in reality. The TRACE model does not incorporate additional household gains from long-term energy savings associated with GGRF-funded efficiency and electrification investments, nor the indirect cost savings that may arise from business-targeted GGRF programs that reduce operating costs. Additionally, the TRACE model does not consider behavior change due to price elasticity (such as reduced household energy consumption due to price increases) as a household benefit.

Household Impacts - Commercial and Industrial Pass-Through

While industrial allocations are not explicitly intended as household protections, the TRACE model finds that 20% of industrial assistance (in the form of free allocation) is passed through to in-state households. This translates to hundreds of millions of dollars per year in household benefits, which are incorporated into the household impact figures described above.[7]

Of all EITE industries, food-related manufacturing (such as dairy and meat processing, snack manufacturing, and breweries) sells the greatest percentage of their products to in-state consumers, leading to the greatest pass-through rates to California households. Petroleum refineries and paper mills also exhibit modestly above-average pass-through rates, relative to other EITE industries.

CARB presents multiple approaches to industrial allowance allocation in the October 29th workshop, labeled Concept 1 and Concept 2. These two approaches create negligible differences in net household impacts, as the majority of household impacts are driven by direct costs and direct benefits from climate dividends.

[7] The TRACE model assumes 100% pass-through of all industries to their end-use customers. As a result, the 20% pass-through rate for EITE industries represents the portion of sales within these industries that is attributable to in-state households.

Key Assumptions

We assume that 2% of future allowance budgets are set aside for APCR reserves. On slide 19 of the workshop materials, CARB states:

"No removal of allowances in the Allowance Price Containment Reserve (APCR) or Price Ceiling accounts; deposit a small amount of post-2030 annual budgets into APCR Tier 1 to bolster cost-containment."

This statement implies that no additional allowances will be moved to the APCR before 2030, other than what is already deposited from the 2021 to 2030 budgets (with a total current size of 156 million allowances). However, on slide 44, CARB suggests that a continuous 2% of allowances will be set aside for APCR reserves, including in pre-2030 years.

The TRACE model computes slightly different allowance distributions than what is suggested on Slides 44 and 45 of the October 29th workshop, as CARB's estimates do not include allowance removals in response to offset use in the prior year. The TRACE model assumes that, beginning in 2027, an amount of allowances is removed from state-owned auctions equal to the amount of offsets used in the prior year. These allowances are solely removed from state-owned allowances designated for auction. Future offset use is assumed to remain at 90% of annual statutory limits, resembling historical behavior. These removals occur consistently each year, regardless of timing with compliance periods.

In the TRACE model, we assume that 2% of future cap budgets are added to the APCR, beginning in 2027. For this model run, the TRACE model was calibrated to industrial allocation Concept 2 for both price and household impact projections. Concept 1 results in negligible differences in model outputs.

For the purpose of household impacts, allowance budget distributions follow reasonable best-fit assumptions based on the current regulation and expected changes. This includes a phase-out of natural gas consignment in favor of electric utility consignment by 2030, after which total consignment allocations decrease proportionately along with the overall cap trajectory. Climate dividends are distributed evenly per household. State-owned allowances for auction (and subsequent GGRF revenue) are calculated as the remainder of annual budgets, after consignment, free allocation, and ACPR reserves have been dedicated on a yearly basis.

Disclaimer

This memo is provided for informational and analytical purposes only. It does not constitute investment advice, financial product advice, legal guidance, or a solicitation to buy or sell any security, allowance, offset, or other market instrument. The analyses, opinions, and interpretations herein are solely those of Greenline Insights, based on information available as the date of publication. They are intended to support transparent, evidence-based policy discussion and are not designed for commercial trading, compliance planning, or speculative decision-making.

Model results reflect a simulated market behavior under a set of assumptions that may not capture all real-world conditions, including forward-looking market expectations, regulatory changes, or behavioral responses by market participants. Actual outcomes may differ materially from modeled results due to updates in policy design, market fundamentals, economic conditions, or unforeseen events.

While reasonable efforts have been made to ensure accuracy and internal consistency, Greenline Insights makes no representation or warranty – express or implied – as to the completeness, accuracy, or fitness of the information contained herein. Greenline Insights and its partners disclaim all liability for any direct, indirect, or consequential losses or damages arising out of the use of this document or its contents.