CALIFORNIA'S CAQ CAP -AND-TRADE EXPLAINED

BALANCING GROWTH WITH CLIMATE STRINGENCY

JUNE 2025

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At a Crossroads:

California's Cap-and-Trade Program

SUMMARY FOR POLICYMAKERS | JUNE 2025 What it is: California's Cap-and-Trade Program is a market-based system that limits greenhouse gas emissions across 85% of the state's economy. It sets an annually declining cap on total greenhouse gas emissions and allows companies to buy and trade licenses (called allowances) to comply. The original issuance by auction of those allowances generates billions in State revenue for clean energy, emission reduction, and sustainable community projects via the Greenhouse Gas Reduction Fund (GGRF). Why it matters now: The program is authorized through 2030 under AB 398. Reauthorization and reform would align it with California's 2045 carbon-neutral goal, provide longterm certainty for investors, and correct weaknesses such as low allowance prices and uneven environmental benefits. Key successes: • Covered the majority of emissions across the state. • Raised nearly \$30 billion for climate and community investments. • Demonstrated compatibility with economic growth. Key challenges: • Balancing Consumer Affordability with allowance prices that incentivize significant emissions cuts is a challenge: policy options to mitigate this should be considered. Offsets and banking of unused allowances offer compliance flexibility, but their reform could reduce emissions further. • Equity concerns persist: industrial emitters can buy allowances instead of reducing local greenhouse gases.

- Tighten the cap to ensure alignment with 2030 and 2045 emission reduction targets.
- Reduce the number of allowances in the system when prices are too low.
- Limit or reform offsets to ensure environmental integrity.
- Introduce carbon removal credits to align with 2045 net-zero goal.
- Target more GGRF spending on hard-to-abate sectors and vulnerable communities.
- Invest more GGRF funds in new technology and California green businesses.
- Introduce a carbon tax on imports (Carbon Border Adjustment **Mechanism)** to address possible loss of business to regions without carbon plans similar to California.

Cap-and-Trade is a POWERFUL TOOL that can be reformed to deliver emission reductions that BALANCE social outcomes with California's climate targets.

Options for reform:

Bottom line:

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The Cap-and-Trade Program, a key part of California's climate efforts, is a way to gradually increase what it costs an entity (usually a company) to release greenhouse gases into the air. The Program's goal is to encourage a transition away from fossil fuels. By starting with a relatively low carbon price and steadily increasing it, the Program aims to secure the most cost-effective emission reductions first and gradually move to more expensive ones over time. This design supports economic progress while delivering emission cuts.

The Program accomplishes this aim by setting a declining annual emissions limit (the "Cap") on emitters. In 2015, that cap was a little less than 400 million metric tons of carbon dioxide; today it is a little less than 300 million tons. Emitters must surrender a "compliance instrument" —usually an allowance—for each ton of carbon dioxide that they emit. Allowances are either freely allocated by the State or purchased from the State at quarterly auctions, after which they can be traded between market participants (the "Trade" component). The rising minimum auction price ensures there is always a cost to emitting: it started at a little more than \$15 per tonne of carbon dioxide in 2014 and stands at \$26/tonne today.

How does Cap-and-Trade support climate policy?

The Cap-and-Trade Program is one of the biggest parts of California's climate policy. AB 32 (Nuñez, 2006) established California's first greenhouse gas reduction target, required the Air Resources Board to produce a Scoping Plan to achieve this target, and authorized them to introduce a Cap-and-Trade Program as one of several policy tools. The California Program stands out among world programs in its comprehensive coverage—about 85% of emissions are controlled under the system, compared to 40% in Europe's system (though the European Union regulates most remaining emissions through other policies). This broad coverage ensures that all of California has some role in reducing our greenhouse gas pollution.

Early and cost-effective action is rewarded because the annual allowance cap declines each year. The Program annually reduces the supply of allowances, creating a long-term price signal for emitters. If emissions exceed the annual cap, the covered parties must either purchase more

BOX 1

Simplifying the Jargon

Emitters: Companies or organizations subject to the Program. This includes any facility, supplier, or importer that emits more than 25,000 metric tons per year of greenhouse gases. It includes utilities, universities, and public institutions if they exceed the threshold. About 85% of California emissions are covered.

Compliance Threshold: Industry and electricity generators must comply if they emit 25,000 metric tons or more of greenhouse gases. However, for electricity importers, natural gas suppliers, and transportation fuel suppliers, compliance begins at the first ton of greenhouse gas.

Compliance Instrument: An allowance or verified offset that must be surrendered (eliminated from the system) to cover each ton emitted under the Program.

Allowance: A license issued by the State that allows the holder to emit one metric ton of greenhouse gases into the air. Allowances can typically be bought, sold, banked, or traded between entities.

Offset: A verified emissions reduction that happens outside the Cap-and-Trade Program, such as improved management of forests. It serves a similar function to an allowance, but it can be used for only up to 4% of the emitter's compliance obligation. They may be bought from outside California, but at least 50% of the environmental benefit must occur within the state.

Leakage: When business production shifts out of state because of compliance costs, resulting in loss of Californian business and no net reduction in emissions. This may be a business leaving the state or losing business to outside competition, and it includes both economic leakage (loss of business) and carbon leakage (no climate benefit).

Money raised from the State's initial allowance auctions fund the California Climate Credit: a direct rebate on utility bills that softens the impact of utilities passing Cap-and-Trade compliance costs to customers. The money also funds the Greenhouse Gas Reduction Fund (GGRF) that supports clean energy and emission reduction projects across the state. GGRF can be invested in projects that reduce climate pollution while advancing economic, equity, and environmental benefit.

How does Cap-and-Trade impact environmental equity and air quality?

It is realistic to assume that reducing fossil fuel use will reduce other forms of air pollution. While the Program is focused on statewide emissions, the Environmental Justice Advisory Committee (EJAC) has raised concerns about local air quality and health impacts, particularly in disadvantaged communities located near refineries, power plants, or industrial sites. These emitters can continue polluting by using allowances—many of which are freely allocated rather than reduce on-site emissions.

While AB 617 (C. Garcia, 2017) addresses these concerns by establishing a program of community-led air quality monitoring and emissions reduction plans, debate continues over whether the Program delivers sufficient localized air quality improvements

How does Cap-and-Trade mitigate economic impacts on consumers & companies?

Companies covered by the program charge consumers more as they cover the cost of purchasing allowances from the State or other covered entities. As well as increasing cost of living pressures, this could harm California's business competitiveness relative to other regions that do not have carbon pricing policies, potentially resulting in business relocation out of state (economic "leakage"). The Program operates with several mechanisms to mitigate these risks:

1. Allocation of free allowances to key industries

Around 38% of allowances are indirectly allocated for free to electricity and gas Investor-Owned Utilities through allowances that are sold at auction, on the provision that this revenue is passed on to ratepayers via the California Climate Credit on utility bills.

A further 15% of allowances are directly allocated for free to industrial sectors deemed at high risk of relocating (leakage) due to increased compliance costs. Currently, free allowances are distributed to petroleum refining and cement production. California's cement sector has historically operated with 100% assistance via free allowances. If needed, these free allocations of allowances can decline more slowly than the overall cap, particularly in sectors like cement. Further, as allocations are based on production levels, a facility can receive more free allowances in a given year if it increases output.

2. Price containment

The Air Resources Board holds in reserve a portion of allowances for the Allowance Price Containment Reserve. These allowances are released to the market if the price rises above identified tiers, operating as "speed bumps" to prevent extreme price spikes. If the speed bumps are breached and the price rises further to the Price Ceiling, an unlimited number of allowances are available at this fixed price, providing an absolute limit on possible price hikes. Notably, neither mechanism has been triggered, and prices have uniformly remained well below these limits.

3. Banking allowances

Covered emitters may "bank" unused allowances for future compliance. This enables entities to hedge against future price increases or unexpected changes in emissions. Emitters are limited on the total number of allowances they can hold at one time to prevent market manipulation. However, there appear to be a large number of banked allowances today, including many banked during the Covid economic slowdown in 2020–2021, when emissions were low. Banked allowances suppress the allowance price by making entities more confident they can purchase needed credits in the future, though they also help buffer the market against volatility.

4. Use of offset credits

Emitters can "offset" up to 4% of their emissions, reduced from 8% in 2021. These credits enable compliance through purchasing a verified emission reduction from outside the capped market. Around 80% of offset credits bought by regulated emitters have gone to forestry projects that aim to reduce deforestation or improve the health of forests in the United States, with others financing livestock methane capture, mine methane capture, and destruction of ozone depletion substances. Recent rules require at least half of an emitter's offsets to provide environmental benefit to California. The use of offsets effectively increases the supply of compliance instruments (allowances plus offsets) in the Program, putting downward pressure on the carbon price.



How does Cap-and-Trade interact with other climate policy?

Cap-and-Trade does not operate in isolation. Rather, it overlaps with several complementary policies that also drive emissions reductions, including (among others):

- The Low Carbon Fuel Standard (LCFS), which reduces the carbon intensity of transportation fuels,
- Zero-emission vehicle (ZEV) mandates, which require increasing sales of electric and hydrogen vehicles,
- Renewable portfolio standards, which drive the expansion of clean electricity, and
- Building energy codes and appliance efficiency standards, which lower emissions from homes and businesses.

Cap-and-Trade is referred to as a "back-stop" that ensures a carbon cost of any emissions not controlled by other regulations, such as those listed above. These overlapping policies can impact Cap-and-Trade by reducing greenhouse gas emissions, suppressing allowance demand and the carbon price, potentially resulting in higher emissions elsewhere. This "waterbed effect" means success in one policy can reduce demand and unintentionally weaken the carbon price. By contrast, if the regulation is weakened and not effectively reducing emissions, the carbon price is still there to serve as back-stop. Direct regulations must be carefully balanced with the market-based Cap-and-Trade Program.

What happens to auction revenues?

Companies obtain allowances through quarterly auctions, which raise billions of dollars each year. As well as funding the California Climate Credit on utility bills, these sales fund the Greenhouse Gas Reduction Fund (GGRF). Around two thirds of GGRF revenues support continuous appropriations: funding automatically directed by statute to long-standing programs, such as affordable housing developments and construction of high-speed rail. The remaining one third is distributed through discretionary appropriations, allocated annually through the budget process and spread across a range of programs, including zero-emission transportation, wildfire mitigation, and clean energy projects statewide. Over half of GGRF investments benefit disadvantaged, low-income, and vulnerable communities, exceeding the statutory minimum of 35%.



Figure 2. Allocation of GGRF appropriations (\$28.7 B) through May 2024. Re-published with permission from Net-Zero California (<u>https://www.netzerocalifornia.org/</u>).

FUTURE REFORMS OF THE PROGRAM

Why is the future of Cap-and-Trade being discussed now?

California's Cap-and-Trade is authorized through 2030 by AB 398 (Garcia, 2017). New legislation will be needed and is being pursued now to provide greater business certainty and to encourage continued clean energy investment. Until 2030, the Air Resources Board can reform and update the system using existing statute.

There are active discussions concerning how to reform the Program. These discussions include the role of the Program in California's climate targets, the balance between costeffectiveness and equity, and whether priority should be given to greenhouse gas reduction, affordability, air quality, or climate resilience.

Major challenges arise from the complex expectations various parties have for the Program. Reducing climate pollution is paramount, but there are expectations that the Program should also reduce conventional air pollution. Also, GGRF funding is expected to support many initiatives, encouraging higher carbon prices, but these prices impact costs for consumers and businesses. Balancing these goals is the key issue for the Program update. Most of the reforms being discussed would put significant burdens on State agencies to implement them properly: these costs and structural changes must also be considered.

What are the risks of delayed policy certainty?

Businesses need regulatory certainty to plan capital investments for infrastructure, clean energy, and industrial decarbonization. Until reforms are discussed and final decisions made, business investment can slow or be redirected elsewhere, affecting near-term job creation and tax revenue. A clear extension and reform of the Cap-and-Trade Program will send an unambiguous signal to the market of policy direction, supporting the environmental and economic co-benefits of California's climate policy.

Why does the Program need to be more stringent?

Several recent developments indicate that a more stringent Cap-and-Trade Program is needed:

1. New statutory targets: AB 1279 (Muratsuchi, 2022) established a net-zero carbon dioxide goal and an 85% reduction in emissions by 2045, relative to 1990 levels. This 85% reduction indicates a role of up to 15% for carbon dioxide removal, the net removal of carbon dioxide from the atmosphere, achieved through several technologies (see below).

2. Scoping Plan guidance: The Air Resources Board's 2022 Scoping Plan Update identified that carbon dioxide emissions need to fall 48% by 2030, relative to 1990, to be on track for the 2045 net-zero target. That plan establishes a major role for carbon dioxide removal, removing as much as



100 million metric tons of carbon dioxide per year by 2045, comparable to Lawrence Livermore National Laboratory estimates, and approximately one quarter of the state's total emissions today. These removals are not part of today's Program.

3. Inventory adjustments: Updated AB 32 Greenhouse Gas Emission Inventory increased previous estimates of the state's emissions.

4. Carbon price concerns: The carbon price appears to be too low to exert substantial market pressure, having remained near the price floor for the history of the Program. Companies simply purchase allowances instead of reducing emissions. The ability to bank allowances means that many unused allowances are currently held. This will limit the carbon price in the coming years. The low price is the biggest challenge to the climate goals of the Program, while raising the price is a major challenge to its economic impacts.

These developments have led the Air Resources Board to explore reforms to the system that would keep California on track to meeting 2045 climate goals. The Air Resources Board held six public workshops in 2023–2024 and published an economic analysis of options for greater stringency in 2024.

What are the mechanisms for greater stringency?

1. Reducing the cap on allowances

The cap currently declines at approximately 4% per year. The Air Resources Board is considering a steeper decline from 2025 onward to bring the system on track to 2030 and 2045 emission reduction targets. Reducing the supply of allowances would create upward pressure on their price, incentivizing deeper emission reduction.

2. Introducing an emission containment reserve (ECR)

While the Air Resources Board has a pool of reserve allowances to enter the market when the carbon price is high, there is no symmetrical mechanism to remove allowances when the carbon price is too low. By contrast, an emissions containment reserve (ECR) operates in the northeastern US carbon market. It removes allowances when prices fall below a set threshold, putting upward pressure on the carbon price. A similar mechanism could be introduced to California's Program to maintain price pressure.

3. Restricting offset use

The use of offsets increases the supply of compliance instruments by 4% per year, putting downward pressure on the carbon price. Many offset projects have been subject to criticism over their "reversibility." For example, a forest credited for storing carbon dioxide later dies from fire, disease, or logging. Offset projects can also suffer from "additionality," where the credited project would have occurred even without the offset. The offset mechanism could be reformed in several ways:

- Washington State's cap-and-invest program allows a limited number of offsets; however, unlike in California, their use reduces the overall cap,
- In Oregon's system, a limited number of offsets are available at a fixed price, and
- California's system could replace offsets with carbon dioxide removal credits (see below) as a higher integrity alternative to offsets.

4. Introduce carbon dioxide removal credits

Removing carbon dioxide from the air will be required to achieve net-zero carbon emissions by 2045. This removal is needed to balance emissions that are very expensive or not practical to reduce to zero, such as emissions of nitrous oxides from fertilizer use. There is growing interest in integrating carbon dioxide removal credits with the Cap-and-Trade Program. SB 308 (2023) proposed funding carbon dioxide removal through Cap-and-Trade. While not successful, it addressed several key considerations, such as the durability of removals, additionality, and scaling over time, which the Air Resources Board will have to consider in verifying removals to meet the State's 2045 net-zero goal.

The European Union and United Kingdom are both exploring integration of carbon dioxide removal with their own Emission Trading Schemes. Washington State's capand-invest program allows carbon dioxide removal as long as the cap remains unchanged. SB 905 (Caballero, 2022) establishes a framework for carbon dioxide management; the Air Resources Board's implementation of this law will shape how carbon dioxide removal might eventually be integrated in the Cap-and-Trade Program.

ECONOMIC IMPACTS OF THESE REFORMS

Will a more stringent Program harm California's economy?

A more stringent Program would very likely increase the cost of compliance, though the exact impact would depend on several factors, including the cost-containment measures, availability of banked allowances, economic activity, availability of emission reduction technology, and interaction with other climate and energy policies.

California's economy has demonstrated that it can grow while reducing greenhouse gas emissions. However, steeper emission declines are required to meet the 2045 climate goal. Although a decarbonized energy system in 2045 could ultimately reduce energy costs for households and industry, the transition period requires major capital investments and risks increasing near-term energy burden on households and business, particularly those with limited financial resilience.

At the same time, the cost of inaction is substantial. Climate change poses severe economic and human health threats to Californian households. The recent wildfires in Los Angeles are estimated to have cost the economy tens of billions of dollars in damages. A more stringent Program could help reduce long-term climate risks, but careful policy design will be needed to manage several short-term transition impacts and ensure an equitable shift to a low-carbon economy.

What are the affordability concerns of a more stringent Program?

Cap-and-trade programs are somewhat regressive since low-income households spend a greater share of income on energy and transport. Without appropriate mitigation measures, a more stringent Program could worsen:

- Cost of living pressures, particularly in households and transportation, given California's already high electricity and gasoline prices,
- Domestic migration out of state, as households seek lower-cost states, and
- Economic leakage, as businesses lose competitiveness relative to those out-of-state, potentially resulting in closure or relocation and loss of jobs.



Affordability pressures are exacerbated by California's persistent housing supply shortage, which has an indirect impact on the cost of commuting and car ownership for workers facing long-distance travel.

Will a more stringent Program increase economic leakage?

Greater compliance costs could reduce competitiveness of California-based businesses that face off with out-ofstate companies operating without a similarly stringent carbon market. Leakage risk is not static. The level of risk depends on factors besides cost of compliance, including other policies or incentives for that business sector, global competition, availability of technologies to reduce emissions, and the time spent in the permitting process before new technologies can be deployed.

The Air Resources Board has identified that the cement and petroleum refining sectors are at particular risk, owing to high production emissions and intense pressure from imports. Moderate risks are currently identified for glass and paper manufacturing and some food processing.

The Climate Center and the Air Resources Board have both noted that the risk of leakage can be reduced by strong local-market ties and targeted support.

MANAGING THESE ECONOMIC IMPACTS

How can economic impact be mitigated under a more stringent system?

There are several policy options that could balance the need for a more stringent Cap-and-Trade system with mitigating the impacts on affordability and economic leakage.

1. Targeted use of Cap-and-Trade revenues

Although allowance auction revenue will vary according to the cap and the market price, it should remain substantial under a more stringent Program. The Air Resources Board expects GGRF revenue to increase. Use of this increased revenue could target initiatives that both mitigate economic impacts of the Program while also delivering emission reductions, including the following:

- Continued investment in affordable housing near major employment centers.
- Targeted investment in the transition away from fossil fuels in hard-to-abate industrial sectors and communities with limited access to clean energy alternatives.
- Prioritizing public investments that de-risk private capital or deliver low-cost high-impact emissions reduction.
- Providing a rotating investment pool to help grow new California clean energy businesses. It is difficult today to allocate funds of this kind because two thirds of the GGRF allocation is established by statute: this could be reformed.

2. Introducing a Carbon Border Adjustment Mechanism

Currently, electricity is the only imported product subject to the carbon price of the Cap-and-Trade Program. Other imports, such as cement, steel, and fertilizer, do not face the same carbon costs as California producers.

A Carbon Border Adjustment Mechanism would address this. For example, the carbon cost of imported cement would be subject to a tax equal to the cost of compliance of domestically produced cement. This would:

- Reduce the risk of economic leakage, by leveling the playing field for in-state business.
- Reduce the risk of carbon leakage, whereby production moves out of state, potentially at higher carbon cost than domestic production.

A Carbon Border Adjustment Mechanism—either taxing out-of-state products that do not meet the carbon footprint of Californian products or banning them outright—could remove the need for free allowance allocation to Californian industry. This would increase the cost of compliance, some or all of which would be passed onto consumers. However, the funds raised from allowance sales could be targeted at emission reduction—and therefore compliance cost reduction—in that sector, such as investing in carbon capture and storage at California's cement production facilities.

The European Union's Carbon Border Adjustment Mechanism will enter into force in 2026, requiring importers to purchase a certificate based on the carbon content of the imported good. A Carbon Border Adjustment Mechanism is one of the proposals most demanding on State agencies since the carbon impact of imported goods must be assessed, reported, and verified. This is currently done for many fuels under the Low Carbon Fuel Standard, and for electricity under the existing Program. Other products would need new assessment mechanisms. However, a Carbon Border Adjustment Mechanism could be very targeted and an effective way of balancing the needs of California consumers and businesses.



ANALYSIS OF CAP-AND-TRADE PERFORMANCE

Is the California Cap-and-Trade program having the desired effect?

California's greenhouse gas emissions have fallen significantly over the last two decades (Figure 3), but isolating Cap-and-Trade's specific impact is difficult.

The Cap-and-Trade Program aims to reduce greenhouse gas emissions, fund climate investments through the Greenhouse Gas Reduction Fund (GGRF), reduce pollution other than greenhouse gases, and ultimately end fossil fuel use in California. While a broad range of projects have been successfully funded via the GGRF, progress towards other aims of the Program are less certain.

Many major emitters comply by purchasing allowances rather than cutting on-site emissions, limiting local air quality benefits. While the Program's impact on greenhouse gas emissions is not obvious in Figure 3, this could be hidden by the dramatic growth of California's economy during this period. This is true for the Low Carbon Fuel Standard (LCFS), a highly targeted sectoral policy that has no mechanism for avoiding the annual compliance targets. Even there, with about 27 million metric tons of avoided emissions in 2022, transportation emissions have only fallen about 20 million tons since the LCFS inception. This is due to increased transportation fuel use in the state.

Figure 4 shows the most compelling evidence that the Program can achieve more in terms of its climate ambitions: the auction price for allowances has been near the price floor for most years of the system. Recent auctions are once again very close to the price floor (Figure 4), putting very little pressure on polluters to make real changes when the allowances can be readily purchased. As early, low-cost emission reductions are implemented, the remaining emission cuts are expected to require more expensive measures—costs that are unlikely to be triggered by the current \$29 allowance price.

A similar depression in price has occurred recently in the LCFS. One likely reason for both price depressions is that new technologies and new projects have significantly expanded the capacity for complying with the requirements of both programs. In the case of LCFS, the expectation of 500,000 metric tons of direct air capture capacity coming online in 2027 from the Occidental/Carbon Engineering



CALIFORNIA GHG EMISSIONS AND CLIMATE TARGETS (2000-2022)

Figure 3. California greenhouse gas (GHG) emissions since 2000 (from CARB Sept. 20, 2024 report). SB 1368 banned long-term electricity imports with footprints larger than a good combined-cycle natural gas fired plant. The Low Carbon Fuel Standard (LCFS) restart refers to the beginning of annual target changes following litigation.

project in Texas has suppressed the price. While new capacity suppresses these prices, by increasing supply and reducing compliance pressure, this reflects real emission reductions, an outcome that ultimately benefits the climate and marks a success for both programs. As supply has outpaced demand in each program, surplus LCFS credits and Cap-and-Trade allowances have been purchased and banked in advance, as entities hedge against the risk of future price increases. The challenge is to have the Cap-and-Trade Program respond appropriately when new technology comes online: it should continue to provide cost pressure on polluters. The Program can maintain upward price pressure without putting undue burden on consumers. Today, there is very little price pressure on consumers, but neither is there clear success in reducing greenhouse gas emissions or other air pollution or in moving toward a fossil-free California. There is clearly room for the Cap-and-Trade Program to have a greater benefit to our climate future if the economic impacts can be mitigated appropriately.



Figure 4. Price for auctioned allowances (credits) in the joint California/Quebec cap-and-trade system. From https://ww2.arb.ca.gov/ our-work/programs/cap-and-trade-program/program-data/cap-and-trade-program-data-dashboard

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