

# An Impact Analysis of AB398 on California's Cap-and-Trade Market

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## **Abstract**

With discussion around California's cap-and-trade outlook post-2020 ongoing, this report has been compiled to provide an impact analysis of AB398 on California Carbon Allowance (CCA) prices through 2030. The latest extension proposal recommends several adjustments to the current program regarding the future supply of allowances, adjustments to the Allowance Price Containment Reserve (APCR), and revisions to the use of carbon offsets with a prioritization of California in-state offsets that provide direct air and water quality benefits.

For our analysis, we build on the existing Western Climate Initiative (WCI) carbon price forecast produced by CaliforniaCarbon.info which forecasts allowance demand based on fossil fuel consumption in the WCI carbon markets. This analysis works on the new mechanism for APCR reserves and builds scenarios to compare the impacts of reducing offset quotas and restricting the use of out-of-state offset credits.

Analysis within this report suggests that the supply of in-state offsets would at maximum meet no more than 0.4% of the total projected compliance offset demand between 2021 to 2030. Over the six scenarios modelled under various provisions for the use of offsets by capped Californian entities, the entirety of allowances contained within the first two APCR tiers, recommended in the new bill, will be exhausted by the latter half of the decade. The report concludes that a decreased offset usage limit and in-state offset requirements heavily increase the reliance on the price ceiling reserve. The overall result is a significant increase in the cost of compliance by \$8.68/ton on average due to the restrictions on offsets as a least-cost compliance measure.

## **Introduction**

California's cap-and-trade program has been the state's flagship initiative for combatting climate change. In order to reauthorize the current program through 2030, state policymakers have been working tirelessly on delivering a post-2020 extension plan capable of securing a two-thirds majority vote.

Commissioned by the American Carbon Registry, this report endeavors to inform discussions around AB398, the latest bill proposal released by the Brown administration. Building on CaliforniaCarbon.info's previous work, this report provides a carbon pricing impact analysis under the new provisions laid out within the bill.

These provisions include amendments to the future supply of California Carbon Allowances (CCAs) and adjustments to the Allowance Price Containment Reserve (APCR), a pool of allowances intended in the event of allowance prices rising too high for the market and economy. Carbon Offsets are also considered an important cost-containment mechanism within the program. The latest bill makes recommendations to

reduce the use of California Carbon Offsets (CCOs)<sup>1</sup> whilst prioritizing those credits generated from offset projects within the state.

With regard to the potential supply of offsets within California and the supply-demand balance of carbon allowances under the latest legislation, the analysis within this report follows base case scenario of CaliforniaCarbon.info's 2030 WCI carbon price forecast to estimate allowance demand projections through 2030. Given the urgency of the analysis and short period between the release of the bill and the voting process, the scope of the report does not include a feedback mechanism wherein the market would anticipate the shortage and act early thus possibly raising prices earlier than expected. Furthermore, this report has rationalized uncertainties about the details of the new design which are detailed herein.

According to CaliforniaCarbon.info's previous emissions modeling, a total of 152,800,721 allowances will remain unused for compliance purposes at the end of 2020 and will be carried over to the next phase of the WCI cap-and-trade program. We assume that this surplus will be adjusted in the post-2020 caps and with the reductions spread equally among the ten years.

## Allowance Price Containment Reserve (APCR)

We calculate the volumes in the APCR as detailed in AB398 wherein two-thirds of the allowances remaining in the reserve by the end of 2017 would be divided equally among two APCR tiers in the post-2020 program. Furthermore, as per the proposed scoping plan, approximately 10.5 million allowances would be assigned into the APCR in 2021. This will be reduced by 1.1 million every year to reach zero levels by 2030. In order to adjust the post-2020 cap and the actual supply of allowances post the APCR quota in a simplified manner, we calculated the percentage of the annual cap post-2020 that would be assigned into the APCR tiers (divided equally between the two tiers) as detailed below:

Year	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
% of cap	3.44%	3.22%	2.98%	2.71%	2.42%	2.05%	1.69%	1.27%	0.81%	0.00%

In addition to the two APCR tiers, a price ceiling with a higher trigger point would also be established wherein all allowances remaining in the reserve at the end of 2020 would be included. The price ceiling would allow the regulators to assign non-tradable allowances at a price cap as needed. We assume that new allowances issued through the price ceiling mechanism would not exceed the shortage seen for any of the years that the price ceiling is triggered.

## Reserve Price, APCR trigger price and Price Ceiling Projections

We use the exiting methodology of calculating the reserve price, i.e. increase the reserve price every year by 5% in real terms, to forecast the reserve prices in the California cap-and-trade program over the next decade. A conservative average inflation rate of 1.5% (2021-2030) is used, and thus, the Reserve Price increases at 6.5% every year during the period of 2021 to 2030.

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<sup>1</sup> Referred to in the Cap-and-Trade Regulation as Air Resources Board Offset Credits or ARBOCs

Similarly, we expect a dynamic price ceiling which is raised annually by 5% plus an inflation rate. We start by assuming a price ceiling at USD 63 for 2021. The APCR trigger price is derived from the difference between the reserve price and the ceiling price for every year. For the APCR tier I trigger price, we add one-third of the difference between price ceiling and reserve price to the reserve price, and for APCR tier II trigger price, we add two-thirds of the difference to the reserve price.

$$\text{APCR tier I trigger Price}_t = \text{Reserve Price}_t + 1/3 * (\text{Price Ceiling}_t - \text{Reserve Price}_t)$$

$$\text{APCR tier II trigger Price}_t = \text{Reserve Price}_t + 2/3 * (\text{Price Ceiling}_t - \text{Reserve Price}_t)$$

Year	Price (USD)			
	Reserve Price	APCR Tier I trigger Price	APCR Tier II trigger Price	Price Ceiling
2021	17.46	32.6	47.82	63.00
2022	18.59	34.8	50.93	67.10
2023	19.80	37.0	54.24	71.46
2024	21.09	39.4	57.76	76.10
2025	22.46	42.0	61.52	81.05
2026	23.92	44.7	65.52	86.32
2027	25.47	47.6	69.77	91.93
2028	27.13	50.7	74.31	97.90
2029	28.89	54.0	79.14	104.26
2030	30.77	57.5	84.28	111.04

## Offset Generation within California

To date the California Air Resources Board (CARB) has issued over 66.4 million carbon offsets over 288 projects. Taking into account those offsets which have been retired in previous compliance periods, forestry credits that are contained in a buffer pool for insurance purposes and a small number of credits that have been invalidated, the total number of CCOs available for future compliance stands at 37.7 million.

Whilst a large number of Registered Offset Credits (ROCs) issued and in the process of conversion to CCOs as well as a high number of forestry projects in the pipeline promise a healthy supply of offsets in the short term, offset supply is anticipated to be well short of demand in the longer term.

Accounting for almost a quarter of the total offsets issued by ARB thus far, California has been the lead provider of offset credits with 16.4 million CCOs being issued across 31 separate projects<sup>2</sup>. Provisions within the latest extension bill (AB398) have proposed a reducing the current offset usage limit of 8% to 4% from 2021-2025 with a minimum mandate of 50% per entity from offsets that provide air quality and water quality benefits in California. From 2026 to 2030 an offset usage limit of 6% would exist with the same 50% carve-out for in-state offset projects.

Under current offset supply scenarios, the supply of California in-state offsets would pose further constraints to the total use of offsets within the program. Should AB398 be written into law, the supply of offsets within

<sup>2</sup> This includes early action projects which date back to 2006

California will therefore have an increasing importance to not only emission reduction projects across the country but also CCA prices.

This section of the report aims to assess the potential supply of offsets from Californian projects over the near-term.

### Methodologies, Assumptions and Findings

With regard to key assumptions for in-state offset supply, a three-part approach has been taken to model the future volumes of offsets from California in-state projects currently listed amongst the Offset Project Registries.

It is assumed that only projects listed under the forestry and livestock projects would meet the AB398 mandate of in-state offset credits that provide air and water quality benefits. Although substances destroyed under the Ozone Depleting Substance protocol may well be collected within California, the location of the destruction facilities out of state discredit their inclusion within this report. Credits in the buffer pool are not considered for the analysis.

The analysis of offset supply from in-state California projects included calculating future CCO volumes 2020-2030 from:

- 1) Projects that have already been issued CCOs
- 2) Projects that have been issued ROCs that are pending conversion to CCOs by ARB
- 3) Projects that are listed, but have not been issued any credits to date.

Based on this analysis, the total volume of California in-state offsets expected to be generated 2020-2030 is **12,145,751 credits**. Details are provided below.

	Forestry	Livestock	Total
CCO Credited projects	3,081,734	329,012	3,410,746
ROC Credited projects	337,559	134,741	472,300
Listed projects	7,712,641	550,064	8,262,705
Total	11,131,934	1,013,817	12,145,751

- 1) **Volume of Offsets from Future Reporting Periods of Credited Compliance Projects:** Credits from future reporting periods from existing and upcoming Forestry and Livestock projects in California have been considered. This step takes into consideration future reporting periods from credited CCO projects, excluding those that have been assigned ROCs (accounted for separately below). In total, there are 17 projects that fit these criteria. It is assumed that all these projects will be assigned subsequent credits for their next reporting period.

In order to calculate this volume, statistical analysis has been used to calculate a co-efficient for the volume of credits issued from the first RP (RP1) to the second RP (RP2) for both livestock and forestry credits. An average turnover rate for RP2-RP3 and RP3-RP4 has been assumed based on the best available data.

A total of 3,081,734 credits for Forestry projects and 329,012 credits for Livestock projects are expected to be generated from these existing projects

- 2) Backlog of registered credits (ROCs) pending conversion:** At time of writing 15 reporting periods (RP) (2 from the livestock protocol and 13 forestry) have been awarded ROCs that are awaiting final ARB approval before being converted to CCOs. Assuming all ROCs are converted, this step gives the impending supply of CCO volume over the near future. The median lead time for ROC-CCO issuance is 57 days for livestock credits and 98 for forestry projects.

An anticipated 4,339,805 credits from issued ROCs are expected to be converted to CCOs by ARB. Whilst some of these projects are overdue, this supply is expected to enter the market over the coming year. An additional 472,300 credits is calculated from future reporting periods of these projects. 134,741 of these credits will come from livestock projects with forestry projects accounting for the remainder.

**3) Expected issuances from listed, uncredited projects**

Forestry credits based on acreage: There are 38 forestry projects listed that have not yet been credited with either ROCs or ARBOCs. Due to the scale of forestry projects, the projected volume these projects will yield is significant to the future supply of Californian offsets.

A large number of forestry projects were listed prior to protocol changes made in 2015. While not all of these may be developed and issue credits, it is assumed that all projects will go forward.

To forecast the potential volume for RP1 from these projects, statistical analysis has been used to determine offset volume based on the projects size (acreage). RP2 of Improved Forest Management (IFM) forestry projects was found to yield around 5.4% of the first reporting period.

It is calculated that 9.9 million credits from initial reporting periods could be unlocked should all of the IFM forestry projects listed under the 2015 protocol come to fruition.

Livestock projects: Only 5 livestock projects are yet to gear up for issuances. It is assumed these projects will gain the average, 18,245, number of credits for their first reporting period.

Far smaller in size and with a lower backlog of projects, 91,225 credits are estimated from the RP1 of listed livestock projects

## Conclusion

The analysis of offset supply from California projects, even while considering only credits from the existing and pipeline of listed projects, results in only 12 million tons 2020-2030, which pales in comparison with the overall potential offset demand. A comparison of actual 2020-2030 potential demand with offset supply is provided in Figure 1 (page 11) to further highlight this fact under different scenarios based on CaliforniaCarbon.info's offset demand forecast for in-state offset projects.

## Price Impacts under Various Scenarios

To measure the impact of provisions regarding the use of offsets in the new program design, we have formulated six scenarios which include various limits for offset usage with and without restrictions placed on credits generated from projects based outside of California. We also assume that entities would use their entire offsets quotas from 2021 as a cost effective measure to meet compliance and save allowances for surrender with expectations of prices rising to the ceiling

Our analysis finds the year in which each of the price containment reserve would be triggered and the extent to which the price ceiling reserve would be relied on under various scenarios detailed below. The prices listed are weighted average annual auction clearing prices (i.e. the product of total allowances and their expected price divided by total allowances.)

### Scenario 1 – Business as Usual (BAU) CCA Price Forecast for 8% offset usage limit, no in-state offset requirements, with new APCR adjustment but no change in post-2020 caps in response to market surplus

Year	Weighted Average Price (USD)
2021	17.72
2022	18.86
2023	20.09
2024	21.42
2025	22.87
2026	44.72
2027	50.59
2028	63.80
2029	57.12
2030	71.07
Average Price (2021-2030)	38.38

In this Business as Usual (BAU) scenario we assume that the program would maintain the current maximum offset quota at 8% with no in-state offset requirement. The APCR reserve volume would be allocated as detailed in the methodology, but the post-2020 caps would not be adjusted for the 2020 surplus.

We find that the market reaches a cumulative shortage in 2026 which is satisfied after triggering the first APCR tier. However, in 2027 the Price Ceiling reserve along with the APCR is triggered. Due to the large volume of allowances initially kept in the Price Ceiling reserve, the supply and demand balance returns to a surplus in 2028 which is eroded at the end of the year and additional allowances will have to be released.

Following is the summary of allowances purchased at each reserve tier:

APCR Tier 1 – 65,295,637 tons

APCR Tier 2 – 65,295,637 tons

Price Ceiling – 266, 762,623 tons

**Scenario 2 – CCA Price Forecast for 8% offset usage limit, no in-state offset usage requirements with new APCR and supply adjusted for pre-2020 surplus**

Year	Price (USD)
2021	17.72
2022	18.87
2023	20.11
2024	21.46
2025	41.99
2026	47.33
2027	59.85
2028	56.12
2029	66.88
2030	72.89
<b>Average Price (2021-2030)</b>	<b>41.85</b>

This scenario maintains the current 8% offset usage quota with no in-state offset requirement and APCR revisions, but also adjusts the post-2020 caps as per the 2020 cumulative surplus.

The tier 1 reserve is triggered in 2025 and subsequent reserves are triggered progressively in the following years with the market not reaching a surplus in any of the years after 2025. The amount of allowances to be purchased in each of the tiers is as follows:

APCR Tier 1 – 65,295,637 tons

APCR Tier 2 – 65,295,637 tons

Price Ceiling – 421,386,981 tons

**Scenario 3- CCA Price Forecast for 8% offset usage limit, 50% in-state offset usage requirement, with new APCR and supply adjusted for pre-2020 surplus**

Year	Price (USD)
2021	17.72
2022	18.88
2023	20.13
2024	21.52
2025	51.75
2026	55.87
2027	50.47
2028	62.15

<b>2029</b>	67.76
<b>2030</b>	73.78
<b>Average Price (2021-2030)</b>	43.52

In this scenario, we assume an 8% offset usage limit with a requirement for 50% from in-state projects. The 4% in-state quota allows for the use of a total of 123,515,444 in-state offset credits in the next decade, however, the supply from in-state offsets falls massively short of this mark at just 12,145,751 tons.

We see both the APCR reserves being triggered in 2025 and price ceiling being tapped every year from 2026 to 2030. The breakdown for allowances bought from each reserve is as follows:

APCR Tier 1 – 65,295,637 tons

APCR Tier 2 – 65,295,637 tons

Price Ceiling – 532,859,670 tons

**Scenario 4 – CCA Price Forecast for 4% offset usage limit 2021-2025 and 6% 2026-2030, with no in-state offset requirement with new APCR and supply adjusted for pre 2020 surplus**

<b>Year</b>	<b>Price (USD)</b>
<b>2021</b>	17.72
<b>2022</b>	18.88
<b>2023</b>	20.14
<b>2024</b>	39.43
<b>2025</b>	59.89
<b>2026</b>	55.99
<b>2027</b>	50.15
<b>2028</b>	61.77
<b>2029</b>	67.37
<b>2030</b>	73.39
<b>Average Price (2021-2030)</b>	45.92

This scenario represents a reduced offset usage limit of 4% between 2021 and 2025 and 6% between 2026 and 2030 with no in-state offset requirements. The new APCR mechanism and surplus adjustments are put in place as well.

Our analysis finds that the APCR tier 1 is triggered in 2024, then in 2025, the tier 2 is also triggered and entities will have to rely on the price ceiling to meet obligations from 2026 onwards.

APCR Tier 1 - 65,295,637 tons

APCR Tier 2 - 65,295,637 tons

Price Ceiling – 514,630,639 tons

**Scenario 5 – AB 398: CCA Price Forecast for 4% offset usage limit 2021-2025 and 6% 2026-2030 with requirement of 50% in-state offsets throughout with new APCR and supply adjusted for pre-2020 surplus**

Year	Price (USD)
2021	17.72
2022	18.88
2023	20.14
2024	39.43
2025	59.89
2026	55.77
2027	53.49
2028	62.49
2029	68.11
2030	74.14
<b>Average Price (2021-2030)</b>	<b>46.54</b>

This scenario models the impact of AB 398 proposed offset usage limit of 4% 2021-2025 rising to 6% 2026-2030 with requirement for 50% in-state offsets through the term. . The APCR and price ceiling reserves are triggered in the same manner as scenario no. 4, however, an additional 64,547,322 tons will need to be bought from the price ceiling compared to the former case, solely due to the lack of supply from in-state offset projects.

APCR Tier 1 - 65,295,637 tons

APCR Tier 2 - 65,295,637 tons

Price Ceiling – 579,177,962 tons

**Scenario 6 - CCA Price Forecast for 8% offset usage, with 2% of total offset usage reserved for in-state projects, and new APCR and supply adjusted for pre 2020 surplus**

Year	Price (USD)
2021	17.72
2022	18.87

2023	20.11
2024	21.47
2025	41.99
2026	58.43
2027	47.62
2028	60.31
2029	67.28
2030	73.29
<b>Average Price (2021-2030)</b>	<b>42.24</b>

This scenario maintains the current 8% offset usage limit, but adds a requirement for 2% in-state offsets. The total in-state offsets allowed amounts to 61,757,722 tons in this case, while the supply falls short by 49,611,971 tons. In 2025, the first tier will need to be accessed to meet obligations and in the following years entities will have to buy allowances at the ceiling price.

APCR Tier 1 - 65,295,637 tons

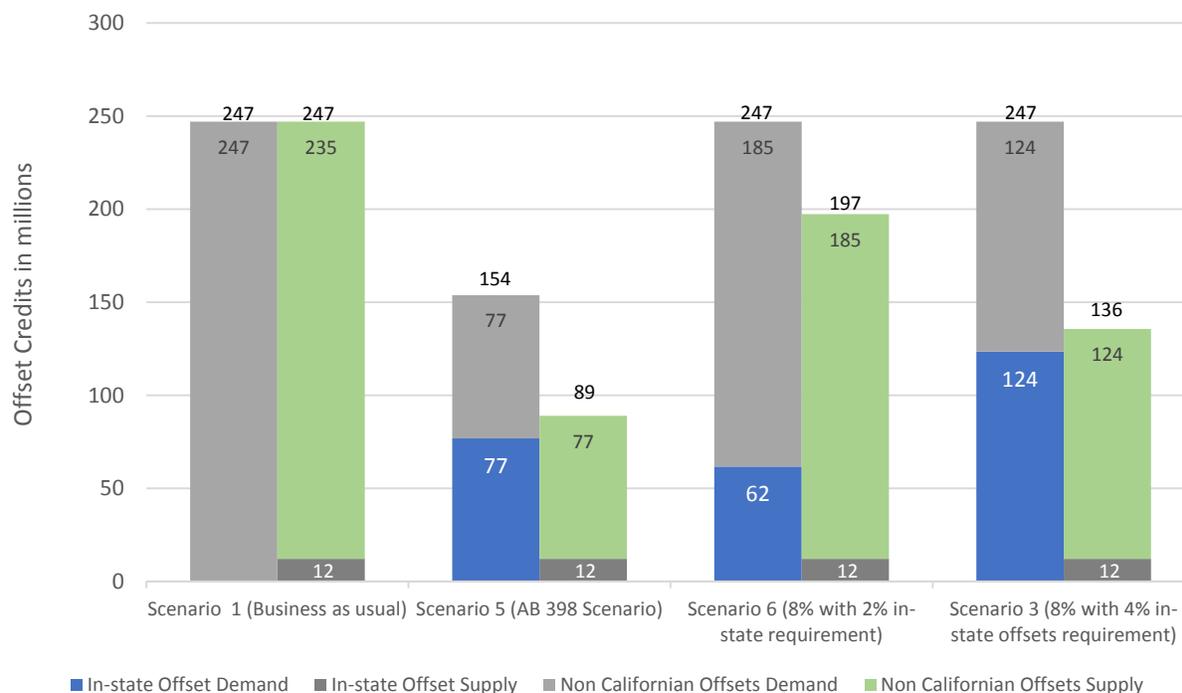
APCR Tier 2 - 65,295,637 tons

Price Ceiling – 471,101,947 tons

## Conclusions

### In-State Offset Requirements

The scenarios detailed above provide for a comparative assessment of various design elements for the post-2020 California cap-and-trade program. However, before assessing the impact on allowance prices, we should note that the in-state generation clause greatly limits the value that offsets provide as a cost containment mechanism in the cap-and-trade program. Our liberal assessments of offset supply from in-state projects which benefit air and water quality between 2021 and 2030 amounts to a little over 12 million tons in total. **This effectively means that in-state offsets would at maximum meet no more than 0.4% of the total compliance demand during the period in California**, a far cry from even the smallest possible mandate of 2%. Thus, any such requirements for compulsory use of in-state offset credit generation would largely go to waste unless offset credit generation in California is increased five folds (or higher depending on the limit) within the next decade, which is highly unlikely



**FIGURE 1: Total Potential Offset Demand Versus Offset Supply from Various Scenarios**

### Comparison of Price Scenarios

In all of the six scenarios modeled by CaliforniaCarbon.info considering various provisions for the use of offsets by Californian entities, we find that the entirety of the allowances in the first two APRC tiers will be exhausted by the latter half of the decade. The key variability is seen in the volume allowances that must be bought through the APCR reserves and further through the price ceiling reserve. It is thus evident that reliance on the price ceiling reserve is minimized with the increase in offset usage quotas and the exclusion of in-state offset requirements.

The table below summarizes and compares the weighted average price through 2021 to 2030 for the six scenarios analyzed in this report. The business-as-usual scenario with 8% offset quotas and no restriction on out-of-state offset credits yields the lowest carbon price, whereas the provision of AB 398 limiting offset usage to 4% in 2021 to 2025 and 6% in 2026 to 2030 along with restriction on the use of out-of-state credits would be the costliest.

Year	Price (USD)					
	Scenario 1 (BAU)	Scenario 2	Scenario 3	Scenario 4	Scenario 5 (AB 398)	Scenario 6
2021	17.72	17.72	17.72	17.72	17.72	17.72
2022	18.86	18.87	18.88	18.88	18.88	18.87
2023	20.09	20.11	20.13	20.14	20.14	20.11
2024	21.42	21.46	21.52	39.43	39.43	21.47
2025	22.87	41.99	51.75	59.89	59.89	41.99
2026	44.72	47.33	55.87	55.99	55.77	58.43
2027	50.59	59.85	50.47	50.15	53.49	47.62
2028	63.80	56.12	62.15	61.77	62.49	60.31
2029	57.12	66.88	67.76	67.37	68.11	67.28
2030	71.07	72.89	73.78	73.39	74.14	73.29
<b>Average Price (2021-2030)</b>	<b>38.38</b>	<b>41.85</b>	<b>43.52</b>	<b>45.92</b>	<b>46.54</b>	<b>42.24</b>

**FIGURE 2: Weighted average price 2021-2030 for each scenario**

Our findings can be seen as conservative in the sense that we do not forecast the impact of the market's anticipation of prices rising to ceiling which would likely pull prices higher in the earlier phases of the program. Also, falling outside the scope of this analysis is the rate at which new projects may be listed under California's cap-and-trade program. In order to forecast the uptake of future project developments, future research should model the overall potential for projects within the state and the pricing signals needed to trigger development. In addition, further analysis should focus on identifying a Marginal Abatement Curve, in which certain pricing signals may trigger abatement across different capped sectors.

With carbon pricing initiatives rapidly evolving across the globe, how California amends their program to maintain environmental integrity whilst minimizing the costs to the economy is becoming increasingly important to international climate efforts.

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