NERA Economic Consulting and Pacific Gas & Electric Company: Cap-and-Trade Program Market Design Study

Summary

Pacific Gas & Electric Company (PG&E) engaged National Economic Research Associates (NERA) Economic Consulting to assess the economic impacts of individual design features of California's Cap-and-Trade (C&T) Program. The study found that two key C&T design features have the largest individual impact on California's economy and households:

- Level of the price ceiling; and
- Removing allowances from the market that results in lower emission caps.

The study also found that the household expenditure impacts from cost increases due to C&T Program features are regressive, meaning low-income households pay a proportionally greater amount of their income, and this regressive impact increases as allowance prices rise. The regressivity does not account for the targeted use of allowance revenue, which could mitigate or reverse these impacts. The California Air Resources Board's (ARB) current C&T design[1] (e.g. price ceiling at post-2020 Allowance Price Containment Reserve (APCR) levels and post-2020 allowance budgets from the C&T regulation adopted in 2017) is more protective of California households and the economy than design alternatives that would increase the price ceiling or remove allowances from the market.

Scenario Design & Assumptions

The ARB is leading the process to amend California's C&T Program, per the direction of Assembly Bill (AB) 398 and ARB Board Resolution 17-21. This amendment process includes decisions on critical design features of the post-2020 C&T Program, including establishing a ceiling on allowance prices, setting emission caps, and determining intermediary price containment points at which additional allowances would be available for sale.

PG&E engaged NERA Economic Consulting to evaluate the market and economic impacts of each significant C&T design feature in isolation.[2] NERA analyzed six scenarios and a reference scenario (see Table 1), with each scenario focused on a discrete change in a C&T design element. All scenarios include:

- The C&T Program with a 2030 target of greenhouse gas (GHG) emissions 40% below 1990 levels and continued decline toward the 2050 target of 80% below 1990 levels;
- Complementary measures that align with California's 2017 Climate Change Scoping Plan;[3]
- Offsets; and
- Linkage with Quebec and Ontario.

[1] Available at: https://www.arb.ca.gov/cc/capandtrade/capandtrade/unofficial_ct_100217.pdf

[2] This study employs NERA's N_{ew}ERA modeling system to analyze the seven scenarios based on three-year time intervals from 2019 to 2040. The system integrates a bottom-up, unit level electricity sector model with a top-down macroeconomic model of the U.S. economy.

[3] Measures include: 50% renewable portfolio standard target, a doubling of energy efficiency in buildings by 2030, the 18% Low Carbon Fuel Standard target in 2030, a zero-emission vehicle requirement, and vehicle miles traveled reduction measure equivalent to the requirements in Senate Bill 375, among others.

Table 1. *Scenario Descriptions*

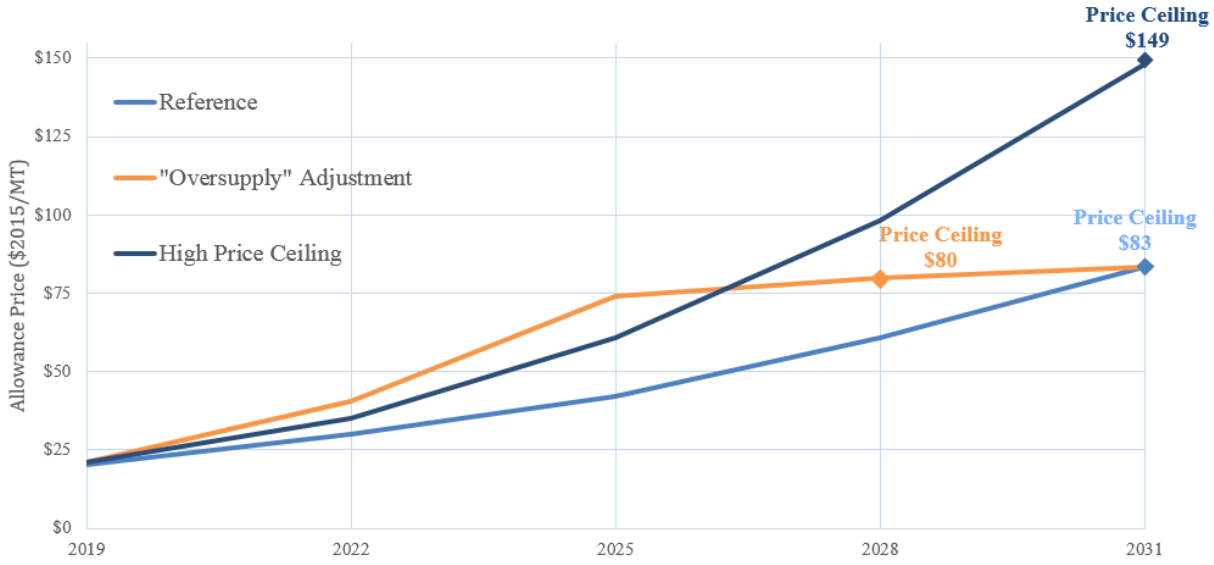
Design Element[4]	Scenario	Description
Price Ceiling	Reference	Low end of ARB's proposed range; equivalent to the current price trajectory for the APCR (~$80/MT[5] in 2030)
	High Price Ceiling	High end of ARB's proposed range (~$147/MT in 2030)
Emission Caps	Reference	Consistent with existing ARB emission caps for 2021-2030[6]
	"Oversupply" Adjustment	Cap reduced by a cumulative 270 million allowances from 2021-2030
Price Containment Points (PCPs)	Reference	120 million allowances divided evenly among two PCPs and price ceiling, with the PCPs spaced evenly between the auction reserve and the price ceiling, and 52.4 million allowances placed in the post-2020 APCR
	Larger Tiers	52.4 million allowances moved from the post-2020 APCR to the two PCPs
	High Price Tier	One large PCP at $70/MT in 2021, with escalation tied to the auction reserve price adder
Offsets	Reference	Consistent with AB 398 offset limits, with escalating utilization rate[7] starting at 55% in 2015, and price discount relative to allowances decreasing from 20% in 2015 to 10% in 2025
	Low Offsets	Restricted supply based on availability of in-state offset projects[8]
	High Offsets	Same offset limits as Reference, but increased supply of low-cost offsets ($5/MT) and increased utilization (90% by 2026)

Results

Figure 1 shows the allowance prices in selected scenarios. For simplicity, the figure only shows three key scenarios, as the other four scenarios are broadly consistent with the Reference scenario. Allowance prices in the Reference scenario reach the price ceiling of $83/MT by 2031. Adjusting emission caps downward, as in the "Oversupply" Adjustment scenario, causes the market to reach the price ceiling earlier, by 2028. The allowance price comes close to hitting the price ceiling of $149/MT in 2031 in the High Price Ceiling scenario, and this scenario delivers consistently higher allowance prices during the 2020s.

[4] All scenarios adopt the Reference scenario design elements outlined in Table 1, unless otherwise specified.
[5] All dollar figures are shown in 2015 dollars and emissions are expressed in metric tons of CO_2.
[6] As adopted by ARB on July 27, 2017 in Table 6-2: 2021-2031 California GHG Allowance Budgets, Regulation for the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms.
[7] 'Utilization rate' refers to the proportion of the overall offset limit used by compliance entities; 55% is roughly equivalent to current utilization.
[8] In-state offset supply derived from American Carbon Registry and CaliforniaCarbon.info offset projections (http://californiacarbon.info/wp-content/uploads/2017/07/AB398-_Impact_Analysis.pdf).

***Figure 1**. Allowance Prices in Selected Scenarios (2015$/MT)*

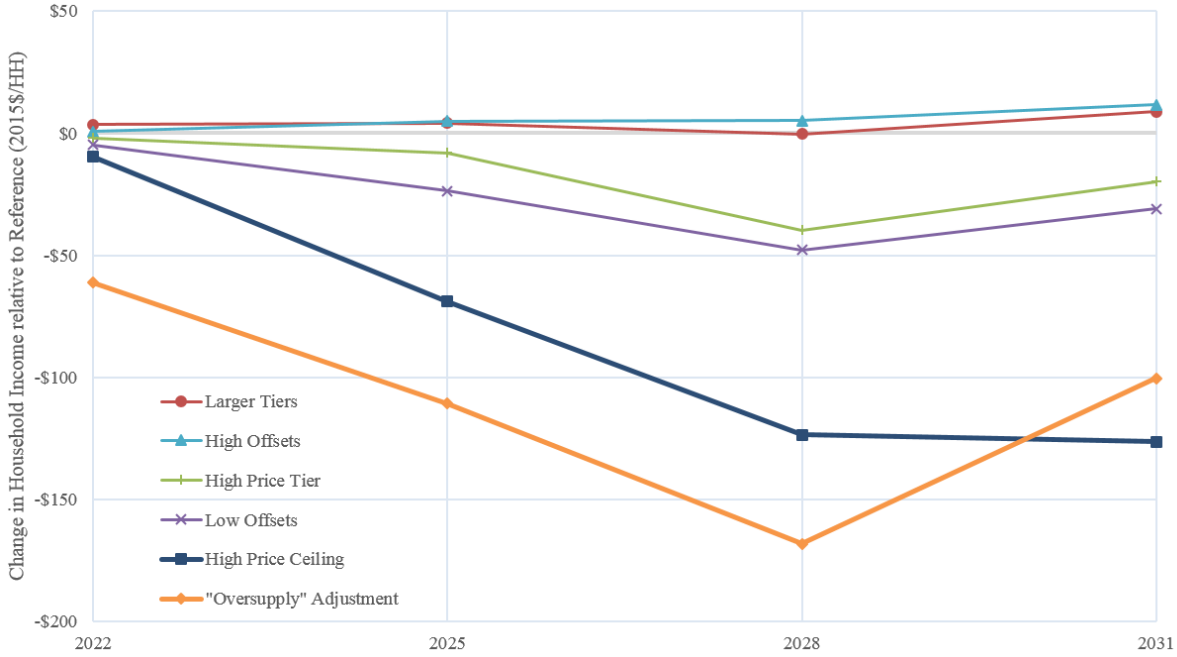


"Oversupply" Adjustment and High Price Ceiling result in higher allowance prices

Figure 2 shows the change in household income relative to the Reference scenario. Both the High Price Ceiling scenario and the "Oversupply" Adjustment scenario result in the largest reductions in household income out to 2031. Other design features have a relatively smaller impact.

Though not modeled, layering multiple design features could have a compounding negative effect on household income.

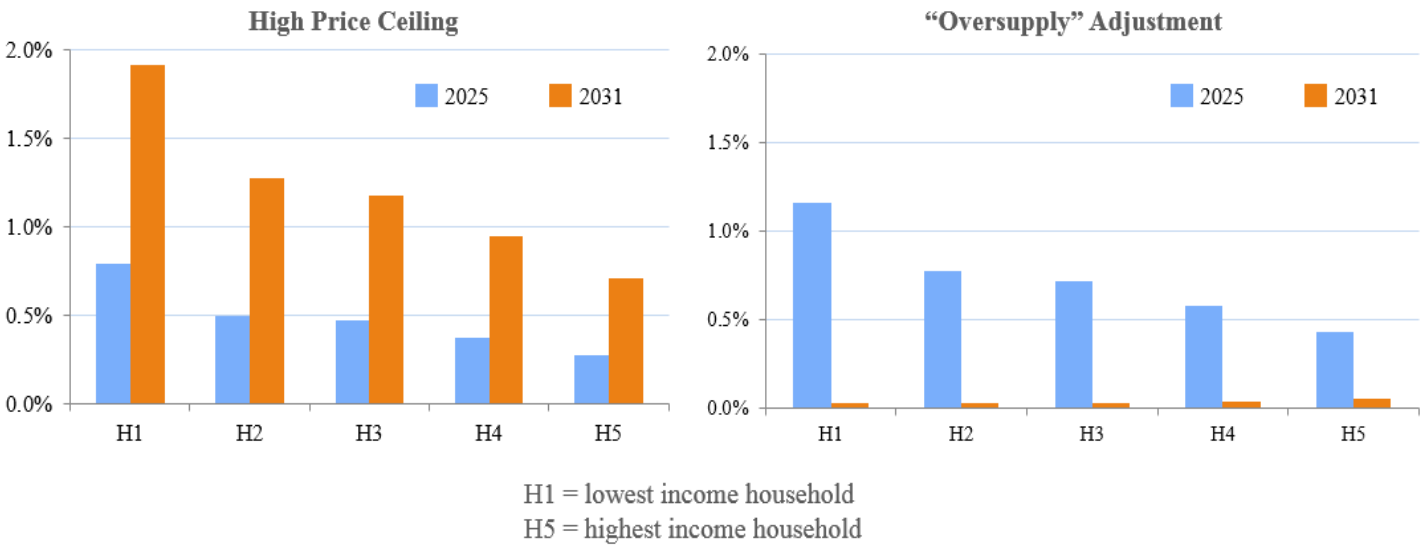
***Figure 2**. Household Income Change Relative to Reference Scenario (2015$/household)*



"Oversupply" Adjustment and High Price Ceiling result in the largest reductions in household income

The study also found that household expenditure impacts are regressive before considering the use of allowance value, meaning the costs that low-income households pay are proportionally greater relative to their income. This regressive economic impact is exacerbated as allowance prices rise, shown in Figure 3. ARB's current C&T design is more protective of California households – particularly for low income households – and the economy than design alternatives that would increase the price ceiling to $149/MT in 2031 or remove allowances from the market.

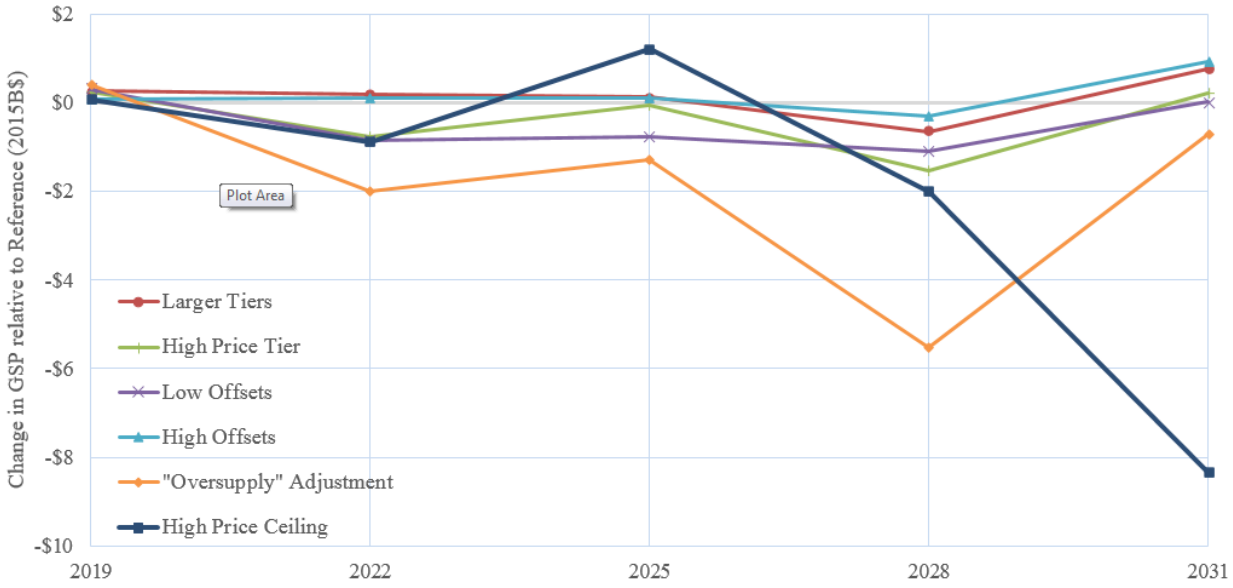
***Figure 3**. Incremental Household Costs Relative to Reference Scenario (%)*



Low income households (H1) face a higher proportional cost burden relative to higher income households

Figure 4 shows results for the change in California's Gross State Product (GSP) relative to the Reference scenario. Consistent with the household impact results, the High Price Ceiling scenario leads to the largest negative impact on the California economy, with the drop in GSP from 2028 to 2031 reflective of the steep escalation in allowance prices. The "Oversupply" Adjustment scenario also has a large impact prior to 2030, but conforms with other scenarios in 2031 as allowance prices reach the same price ceiling as in the Reference Scenario.

***Figure 4**. Change in Gross State Product Relative to Reference Scenario (2015B$)*



"Oversupply" Adjustment and High Price Ceiling have the largest negative impact on the Californian economy

Conclusions

The NERA-PG&E study found that:

1. A relatively high price ceiling level ($149/MT in 2031) would have the largest negative impact on the economy and households.
2. Removing allowances from the market can have significant negative impacts on household income and the economy.
3. Household income impacts are regressive before considering the use of allowance value, meaning low-income households pay a proportionally greater amount, and this regressive impact increases as allowance prices rise.

Note: Developments in Ontario

As noted earlier, all scenarios in this study assumed the ongoing linkage of California's C&T Program with Quebec and Ontario. Effective July 3, 2018, Ontario's new provincial government announced the revocation of Ontario's C&T regulation.[9] Even with Ontario de-linking, the key findings of this study remain largely consistent. However, while not modeled explicitly, Ontario's departure would likely delay when the price ceiling is reached, and reduce the economic and household costs.

[9] See: https://www.ontario.ca/page/cap-and-trade