Claremont Colleges
Scholarship @ Claremont

Pomona Senior Theses | Pomona Student Scholarship

2022

Climate Trailblazer or Corporate Giveaway: An Economic and Political Evaluation of Cap-and-trade in California

Benjamin Reicher
Pomona College

Follow this and additional works at: https://scholarship.claremont.edu/pomona_theses

 Part of the American Politics Commons, Environmental Policy Commons, Environmental Studies Commons, Macroeconomics Commons, Policy Design, Analysis, and Evaluation Commons, Policy History, Theory, and Methods Commons, Political Economy Commons, Public Economics Commons, Public Policy Commons, and the Social Justice Commons

Recommended Citation

Reicher, Benjamin, "Climate Trailblazer or Corporate Giveaway: An Economic and Political Evaluation of Cap-and-trade in California" (2022). *Pomona Senior Theses*. 273.
https://scholarship.claremont.edu/pomona_theses/273

This Open Access Senior Thesis is brought to you for free and open access by the Pomona Student Scholarship at Scholarship @ Claremont. It has been accepted for inclusion in Pomona Senior Theses by an authorized administrator of Scholarship @ Claremont. For more information, please contact scholarship@cuc.claremont.edu.

Climate Trailblazer or Corporate Giveaway: An Economic and Political Evaluation of Cap-and-trade in California

Thesis by

Benjamin Reicher

In Partial Fulfillment of the Requirements for the Degree

of

Bachelor of Arts

POMONA COLLEGE

Claremont, California

2022

Table of Contents

Introduction

Global warming is undoubtedly among the foremost of urgent issues facing today's society, and is only intensifying as more time goes by without governments taking the necessary actions. Data from the Intergovernmental Panel on Climate Change (IPCC) has confirmed that the global climate has warmed about 1℃ above preindustrial levels.[1] Without rapid and decisive reductions in countries' emissions of carbon dioxide and other greenhouse gases (GHGs), the world will see warming in excess of the all-important target of 1.5℃ by around 2050.[2]

Broadly speaking, debates about strategies for addressing climate change through government policy tend to split into two divergent, though not mutually exclusive, camps: one side argues for an approach that leverages market forces to incentivize a shift away from GHG-heavy economic activities (in particular, the burning of fossil fuels), while the other side favors strengthened regulations on businesses to require them to reduce their emissions.[3] Market-based mechanisms have been implemented in the form of emissions pricing, with there being two specific policies through which policymakers can employ this strategy: a per unit tax on emissions ("carbon tax"), or a system of tradeable emissions permits known as cap-and-trade.[4] Economists tend to favor either of these policies as the most efficient method of reducing emissions, in line with standard economic theory about how government action can mitigate a negative externality. This is under the operating principle that, as with any pollutant, large emitters of GHGs must be made to incorporate the social cost per unit of GHG emissions into

[1] Intergovernmental Panel on Climate Change, "Summary for Policymakers," Special Report, 2018, p. 4, https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf
[2] IPCC, "Summary for Policymakers," p. 4
[3] Janet Peace and Jason Ye; Market Mechanisms: Options for Climate Policy. Center for Climate and Energy Solutions, April 2020, https://www.c2es.org/wp-content/uploads/2020/04/market-mechanisms-options-climate-policy.pdf
[4] Center for Climate and Energy Solutions, "Market-Based Strategies," https://www.c2es.org/content/market-based-strategies/

their decision-making, on top of the negligible individual costs.[5] However, many grassroots climate activists view the market-based approach with skepticism, as not strong enough to reduce emissions at the necessary scale, and moreover as perpetuating inequities in fossil fuel pollution across communities, since market-based mechanisms do not address the disproportionate impact of air pollution from GHG co-pollutants (hereafter alternately referred to as "criteria" pollutants) in low-income and majority-minority areas as directly as regulations would.[6]

To determine the true value of market-based mechanisms in the struggle to mitigate global warming, and perhaps to find an optimal balance between market-based mechanisms and regulations, it is most illustrative to analyze a real-life example. Many jurisdictions, both within the United States and worldwide, have employed a market-based mechanism to control their emissions, with over 20 percent of global GHG emissions subject to some form of pricing measure as of 2021.[7] However, perhaps the most sophisticated, and the most comprehensive, market-based mechanism in the world can be observed in the economy-wide cap-and-trade program employed by California.

California's cap-and-trade program, devised under the auspices of the 2006 Global Warming Solutions Act (AB 32), is a classic case of the market-based approach being leveraged to achieve GHG emissions reductions. AB 32 committed California to reducing its GHG emissions to their level in 1990, or to 431 million metric tons of CO_2-equivalent, by 2020. The bill further authorized the California Air Resources Board (CARB) to design and enact measures to achieve that goal, with the possibility of a market-based pricing mechanism allowed but not

[5] Climate Leadership Council, "Economists' Statement on Carbon Dividends," January 17, 2019, https://clcouncil.org/economists-statement/

[6] Anna Phillips, "Environmental Justice Groups Block Mary Nichols' Path to EPA," *The Los Angeles Times*, December 17, 2020, https://www.latimes.com/environment/story/2020-12-17/environmental-justice-groups-block-mary-nichols-path-to-epa

[7] World Bank, "Carbon Pricing Dashboard," https://carbonpricingdashboard.worldbank.org/

required.[8] CARB ultimately designed the cap-and-trade program as part of its emissions reduction strategy for the state, and began implementation in 2013.[9] Under cap-and-trade, CARB holds quarterly auctions where corporations subject to the program must purchase permits that each allow them to emit one metric ton of GHGs, and then lets entities who do not use all their permits sell them to those who need more.[10] Companies can also save ("bank") unneeded permits for future use,[11] subject to a "holding limit" that restricts how many permits one entity can hold in excess of what is needed to meet its obligations under the cap-and-trade program, with the holding limit decreasing as the total number of permits released in a given year decreases according to a predetermined formula.[12] AB 32 requires CARB to regularly release a scoping plan that details the program's progress and its future development; scoping plans have been released in 2008, 2013, and most recently 2017. The next scoping plan is set to be released in late 2022. [13]

The auctioning of a fixed number of permits, a number that decreased annually by about two percent and later (since 2015) by about three percent, constitutes the "cap" in cap-and-trade, guaranteeing a strict ceiling that overall emissions cannot exceed. The secondary selling of unused permits constitutes the trade.[14] Around 450 California business entities, together responsible for about 85 percent of the state's GHG emissions, are subject to the cap-and-trade program.[15] Cap-and-trade initially targeted electricity producers and large industrial operations

[8] California Legislature, Assembly Bill 32, Legislative Session 2005-06, https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=200520060AB32
[9] California Air Resources Board, "Overview of ARB Emissions Trading Program", February 9, 2015, https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/guidance/cap_trade_overview.pdf
[10] CARB, "Overview"
[11] CARB, "Overview"
[12] California Code of Regulations, 17 CCR § 95920
[13] CARB, "AB 32 Climate Change Scoping Plan," https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan
[14] CARB, "Overview"
[15] CARB, "Overview"

with annual emissions of over 25,000 metric tons of CO_2-equivalent, and expanded to cover distributors of transportation fuels and natural gas in 2015.[16] Through this policy, major emitters are incentivized to reduce the overall GHG emissions from their operations, so they will have permits left over that they can sell for a profit. Furthermore, the state collects significant revenue from permit auctions, much of which goes to the Greenhouse Gas Reduction Fund (GGRF), to support additional efforts to reduce GHG emissions and to adapt to the impacts of global warming that are set to be felt in future decades. Since the cap-and-trade program's inception, GGRF funding has been dedicated for clean energy research, rebates for electric vehicle purchases, wildfire prevention, urban forest management, and funding for low-emissions public transit and transit-oriented affordable housing, among others.[17] California law requires at least 25 percent of distributed GGRF funding to go to projects benefiting and located in disadvantaged communities that are disproportionately likely to be locate near sources of fossil fuel pollution, and an additional 10 percent to go to projects benefiting low-income communities and households.[18]

In this thesis, I evaluate cap-and-trade in California on economic and political parameters, to answer the overall question of how California can make its cap-and-trade program more effective. For the economic side of my thesis, I examine 1) the program's effectiveness at reducing GHG emissions in line with California's legally binding climate targets, 2) its ability to achieve these reductions in a cost-effective way (both in isolation and as compared to other policy options), and 3) whether the program imposes a regressive cost burden on low-income Californians. For the political side of things, I explore several factors that influence the political

[16] CARB, "Overview"
[17] California Climate Investments, "Annual Report to the Legislature," April 2022, https://ww2.arb.ca.gov/sites/default/files/auction-proceeds/cci_annual_report_2022.pdf
[18] California Legislature, Assembly Bill 1550, Legislative Session 2015-16, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1550

viability of cap-and-trade in California: a) its ability to win and retain support from different actors on California's political scene, and b) the environmental justice consideration of cap-and-trade's efficacy at reducing fossil fuel pollution that is concentrated in socioeconomically disadvantaged areas, which is crucial to winning buy-in from grassroots activists. I intend for these dual analyses to reveal how the cap-and-trade program is working, where it is falling short, and in what ways it can be improved. I use these analyses to reach a prescriptive conclusion on what changes California should make to its cap-and-trade program so that it can better achieve its economic and political objectives. Related to the above, a secondary question is whether the cap-and-trade program should even be strengthened in the first place; in my thesis, I touch on other climate policy options (in particular, direct regulations on polluters that have also been implemented in California), and examine whether an increased reliance on those options to realize the state's climate targets might provide better outcomes along the economic and/or political metrics. While it is not a major part of my thesis, I will also compare and contrast California's use of emissions pricing to the experiences of other states, territories, countries, and supranational bodies that have implemented either a carbon tax or a cap-and-trade program – both to understand the policies that helped inspire California's cap-and-trade program and were inspired by California in turn, and to better illuminate the California program's strengths and shortcomings.

In Chapter One, I begin with a discussion of what global warming is and why it is so difficult to craft workable policies to address it. I expound further on the economic and political factors that explain why market-based mechanisms have been promoted as the climate strategy of choice, as well as the thinking that motivates their harshest critics. In Chapter Two, I describe the history of the previous employment of market-based mechanisms in the United States, which

laid the groundwork for California, before delving into the specific history of AB 32 and the overall political dynamics driving the development of cap-and-trade in the state, including the program's contentious renewal by the state legislature in 2017.

In Chapter Three, I explore the economics of the cap-and-trade program as evidenced by real life. This chapter evaluates the program's efficacy at achieving the objectives 1), 2), and 3) given above, both in themselves and compared to (or in tandem with) California's regulatory measures. In Chapter Four, I likewise evaluate cap-and-trade in California along the political metrics of success outlined in a) and b), including a comparison to policy alternatives. Chapter Five further informs my discussion of California's cap-and-trade program through a summary of my interview with Fran Pavley, the former California Assemblymember and State Senator who drafted AB 32 and subsequent legislation pertaining to cap-and-trade. Finally, Chapter Six presents my conclusions regarding whether and how California should strengthen its cap-and-trade program so that it can have a greater impact on the state's emissions. I go over analyses of how California's experience compares to other jurisdictions with market-based mechanisms to reduce GHG emissions (including international comparisons), and finish with a discussion of potential overall conclusions on the strengths and weakness of market-based mechanisms like cap-and-trade compared to regulations.

My analysis of California's cap-and-trade program, ultimately concerned with determining how well the program is fulfilling its promises, has far-reaching implications. In recent years, California's leaders have exerted great effort to portray the state as a leader for the rest of the world when it comes to action on global warming, one that can influence and guide policy discussions on the national and even international arenas. The status of California as a trendsetter for the world makes the state's successes and failures at designing workable and

efficacious climate policies globally significant, even if California itself only produces a miniscule fraction of worldwide GHG emissions. The effectiveness of cap-and-trade in California should thus be seen as a defining test case for the future prospects of cap-and-trade, and perhaps market-based mechanisms in general, as a solution to global warming for a world that is quickly running out of time to take meaningful action.

Chapter One

Global warming (often interchanged with the less precise term "climate change") due to the greenhouse effect from the release of GHGs was demonstrated in lab experiments as far back as the 19th century, and has been recognized as an increasingly alarming trend by scientists since at least the 1970s.[19] Charles David Keeling began daily measurements of atmospheric carbon dioxide at Mauna Loa Observatory in 1958, with his famous Keeling Curve showing a continuous increase in atmospheric CO_2 concentrations in the decades since, from 313 parts per million in 1958 to 400 ppm in 2013.[20] CO_2 is by far the most prevalent of several GHGs that warm the atmosphere, constituting 80 percent of US GHG emissions in 2019; others include methane (CH_4), nitrous oxide (N_2O), and fluorinated gases.[21] While most of these naturally occur in the atmosphere, human activities since the Industrial Revolution of the mid-19th century have increased their concentrations to the point where a global temperature anomaly of more than 1℃, compared to preindustrial levels, can be identified. In the US, the main activities contributing to global warming are the burning of fossil fuels for transportation and to generate electricity, with other sources including the release of GHGs from industrial manufacturing, energy use in

[19] University Corporation for Atmospheric Research, "History of Climate Science Research," https://scied.ucar.edu/learning-zone/how-climate-works/history-climate-science-research
[20] UCAR, "History of Climate Science Research"
[21] Environmental Protection Agency, "Overview of Greenhouse Gases," https://www.epa.gov/ghgemissions/overview-greenhouse-gases

residential and commercial buildings, and agriculture and associated land use changes.[22] Since 1988, the Intergovernmental Panel on Climate Change (IPCC) has served as the world's premier forum for global warming research, and has confirmed that time is quickly running out to avert the worst of the economic, environmental, and societal threats posed by the warming of the planet.[23] Recent data has only made clearer that the impacts of unmitigated global warming will be even more severe than previously anticipated. These include rising sea levels and increased flooding, more frequent and more intense natural disasters like hurricanes and wildfires, acidification of the oceans, and more frequent extreme heat events and droughts.[24] Agriculture and other crucial activities will face severe disruption around the world, with people in developing countries being at risk. After a years-long negotiation process, nearly every country signed the 2015 Paris Agreement, which binds its members to keep warming below 2°C, and to aim for the target of warming below 1.5°C.[25] However, the weakness of the Paris Agreement lies in the fact that it relies on individual countries to decide how much they will cut their GHG emissions as their contribution towards the larger global goal. Although countries are supposed to re-evaluate their Nationally Determined Contributions (NDCs) at annual conferences, as of now member countries' combined pledges to reduce emissions will not be enough to meet the agreement's target.[26]

---

[22] EPA, "Sources of Greenhouse Gas Emissions," https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[23] Brad Plumer, Raymond Zhong, and Lisa Friedman, "Time is Running Out to Avert a Harrowing Future, Climate Panel Warns," *The New York Times*, February 28, 2022, https://www.nytimes.com/2022/02/28/climate/climate-change-ipcc-un-report.html

[24] National Oceanic and Atmospheric Administration, "Climate Change Impacts," https://www.noaa.gov/education/resource-collections/climate/climate-change-impacts

[25] United Nations, "The Paris Agreement," https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement#:~:text=The%20Paris%20Agreement%20is%20a,compared%20to%20pre%2Dindustrial%20levels.

[26] United Nations, "'Climate Commitments Not on Track to Meet Paris Agreement Goals' as NDC Synthesis Report is Published," February 26, 2021, https://unfccc.int/news/climate-commitments-not-on-track-to-meet-paris-agreement-goals-as-ndc-synthesis-report-is-published

The failure of member countries, so far, to take action that would be sufficient to keep warming below 1.5℃ is not due to a lack of scientific knowledge, as the essential facts of what global warming is and the dangers it poses have been known for decades. Nor can inaction be attributed to a dearth of possible solutions: the technologies and techniques that could enable the world to phase out GHG emissions fast enough to keep warming below 1.5℃ do exist, such as zero-emissions energy sources like solar and wind power, electric vehicles, energy efficient construction practices, and (though still in its early stages) carbon capture and storage technology. What is needed is for these solutions to be adopted at a sufficient scale, and indeed they are increasingly being deployed, and have become much cheaper and more accessible even in just the last few years – even becoming cheaper to use than fossil fuels in many cases. Over the past decade, the price of solar power fell 89 percent, while the price of onshore wind fell 70 percent. By 2019, it was cheaper to build out a combination of solar and wind power with battery storage than to build new natural gas plants in the United States.[27] However, the problem remains that, even as the mass appeal of technologies like solar and wind power grows rapidly, these potential solutions are still not spreading at a rate commensurate with emissions reductions that would prevent warming in excess of 1.5℃. The real reason that the world's top GHG-emitting countries have not made reductions fast enough can be ascertained from their governments. While market forces may be favorable to the adoption of emissions-reducing technologies, meeting the Paris Agreement's targets will require government action to promote GHG emissions reductions more directly and effectively, and this simply has not materialized to the necessary extent.

[27] Kristin Toussaint, "The Price of Solar Electricity Has Dropped 89% in Ten Years," *Fast Company*, December 9, 2020, https://www.fastcompany.com/90583426/the-price-of-solar-electricity-has-dropped-89-in-10-years

There are myriad factors, both economic and political, that explain why governments have struggled to enact durable policies to reduce emissions. The main economic problem, naturally, is cost: even if green technologies are increasingly cost-effective at scale, any policy to require the private sector to transition away from fossil fuels is bound to have significant upfront costs, which would be passed on to citizens either through higher taxes or corporations passing the costs of phasing out fossil fuels to their customers. Even if this green transition would more than pay for itself over time, due to the economic losses of global warming being avoided, the short-term cost means that politicians are very aware of the political risk they take in endorsing tough climate policies.

Moreover, the nature of global warming makes it a very difficult problem to address politically. At least up to now, global warming has happened incrementally over a long period of time, before any drastic consequences became evident – slowly, and then all at once – and that has served to disincentivize politicians from prioritizing it. It is hard to rally voters around an issue that is barely visible in their daily lives, and a politician who thinks mainly within the timeframe of the next few years may consider it unlikely that such an issue will win them any political dividends. This de-prioritization and overall lack of urgency leaves a country's political discourse vulnerable to misinformation and obfuscation by the fossil fuel industry and other industries that profit from activities that emit large amounts of GHGs, who may surreptitiously promote manipulated so-called science that seeks to delegitimize the data on the climate crisis, or trumpet false solutions that offer illusory emissions benefits and allow corporate interests to evade government oversight. By the time global warming becomes evident enough, and damaging enough, that voters demand a government response and politicians feel safer endorsing the necessary actions, valuable time to reduce emissions will already have been lost.

Given the economic and political pitfalls that any proposal on global warming faces, coupled with the reality of the progressively closing window of opportunity for action, it is crucial that experts trying to devise government policies to address global warming get it right. The policies they propose must, first and foremost, offer the best possible chance of achieving reductions in GHG emissions with the necessary efficiency. Therefore, the task facing climate policy experts should be grounded in questions of economics, namely how effective a policy option is at reducing GHG emissions on the scale that is needed and how well it can realize those emissions reductions in a cost-effective manner. These questions must be answered before one can consider concerns about political viability. Towards that end, a broad consensus among economists has developed in favor of emissions pricing via market-based mechanisms, taking the form of either a carbon tax or cap-and-trade, as the government policy with the best chance of saving the planet's future.[28]

The appeal of market-based mechanisms is rooted in the conviction that they represent an optimal balance between reducing emissions at the needed magnitude on one hand, and keeping down costs to individual citizens on the other. Fundamentally, emissions pricing recognizes that GHG emissions are a textbook example of a negative externality: an activity that benefits the individuals involved, but imposes costs (in this case, massive ones) on uninvolved third parties and on society as a whole.[29] In other words, activities that create negative externalities have two components that comprise their total cost: a very small observable cost to the individuals who carry out those activities, but a much higher cost to society (which, in the case of burning fossil fuels, rises over time).[30] A livable climate is a common resource – one that is both non-

[28] Climate Leadership Council, "Economists' Statement"
[29] Thomas Helbling, "Externalities: Prices Do Not Capture All Costs," International Monetary Fund, https://www.imf.org/external/pubs/ft/fandd/basics/external.htm
[30] Helbling, "Externalities"

excludable, meaning that everyone can use it without paying for it, and rival, meaning one person's use of it can eventually lead to overexploitation and hinder others from using it. This means that individuals and firms will be incentivized to ignore the social costs of their climate-harming activities and set prices based on the barely significant costs to themselves.[31] Such a state of affairs creates market failure, where the free market allocation of goods creates inefficiencies due to the failure of the price to accurately signal the cost of the good. Therefore, according to supporters of market-based mechanisms, the failure of the invisible hand of the market means the onus is on the government to step in and raise the price of the socially harmful activity, to force the market to incorporate its total cost. Under this pricing strategy (also known as a Pigouvian tax, after economist Arthur Pigou), the market will reflect the additional cost by producing a smaller amount of the negative externality, thus achieving a level that may be considered optimal for society.[32]

In this way, the reasoning goes that the socially desired outcome of reduced GHG emissions can be achieved through the use of market forces. Proponents of emissions pricing argue that it is actually more effective at tackling emissions than regulation (often termed a 'command and control' strategy, one that simply mandates that emitters meet reduction targets). Market-based mechanisms that put a price on emissions incentivize corporations to reduce their emissions as much as they feasibly can, to avoid paying that price. This is especially the case for a cap-and-trade program, where corporations that reduce their emissions as much as possible not only can avoid the obligation to buy emissions permits, but can make a profit selling their unneeded permits to competitors who could not phase out their emissions as efficiently and need

[31] Helbling, "Externalities"
[32] Helbling, "Externalities"

to buy more.[33] (The fundamental difference between a carbon tax and cap-and-trade can be appreciated from the fact that a carbon tax controls the price per unit of GHG emissions with the aim of reducing their quantity; while a cap-and-trade program directly controls the quantity of GHG emissions by only allowing a limited number of emissions permits to be released, and more or less leaves the price per unit to fluctuate in accordance with market demand.) Furthermore, pricing mechanisms are championed as superior to a command and control strategy at the other key objective of keeping down costs: while regulations require corporations to incur compliance costs, creating an added expense that is passed on to consumers, a market-based strategy leaves subject entities free to factor the higher price of emissions into their operations in whatever way is most cost-effective for them. A market-based emissions strategy can encourage cost-saving innovations, by giving corporations the flexibility to reduce their emissions in the most efficient way.[34] Moreover, emissions pricing has a redistributive aspect that can further lower emissions and minimize costs. Either a carbon tax or a cap-and-trade program raises significant government revenue; and that revenue can be spent on incentivizing consumers to shift away from fossil fuels and adopt climate-friendly technologies like rooftop solar panels or electric vehicles, on building resilience to natural disasters and other global warming impacts, or on lowering taxes or a variety of other progressive initiatives that provide people with direct economic benefits.

The economic advantages of addressing GHG emissions through market-based mechanisms are thought to offer political advantages as well, when compared to regulatory measures. First and foremost, this strategy is intended to reduce GHG emissions while avoiding the costs to businesses and consumers that can result from regulations. Emissions pricing is often presented as a bipartisan solution that can appeal to conservative-minded politicians and voters

[33] Environmental Defense Fund, "How Cap-and-trade Works," https://www.edf.org/climate/how-cap-and-trade-works
[34] EDF, "Cap-and-trade"

who are wary of regulatory burdens on business. On the other hand, emissions pricing is often promoted in tandem with redirecting its revenues into dividends paid to households, or towards a wide range of efforts to further incentivize a shift away from fossil fuels and uplift disadvantaged people and communities, including efforts to alleviate the environmental injustice of polluting facilities concentrated in low-income areas. This is not only intended to bring about tangible and progressive benefits to people, but to shore up the political popularity of an emissions pricing strategy among grassroots activists, and among the communities most affected by the fossil fuel pollution that emissions pricing seeks to mitigate. Even better, emissions pricing offers the possibility of accomplishing these improvements to the climate and to public welfare in a fiscally responsible manner.

All these advantages of cap-and-trade are, of course, theoretical, and much of my thesis is dedicated to examining to what extent the example of California bears them out in real-world conditions. It is undoubtedly the case that cap-and-trade, for all its promise, has not been greeted with the same enthusiasm among the grassroots activists and organizations most dedicated to fighting the climate crisis. An ideologically-driven aversion to policies that rely on market forces is part of it, but legitimate concerns have been raised as to whether the planet's future can be entrusted to a policy that doesn't directly require polluting facilities to reduce their individual emissions.[35] A policy targeting corporations' cumulative emissions, many activists argue, cannot be stringent enough to reduce GHG emissions at the necessary rate to prevent the worst global warming impacts. In particular, the price signal from the state program's declining cap on cumulative emissions has been criticized as ineffectual, partly because California allows corporations to bank unused permits and thus (in spite of the holding limit) creates an overall

[35] Emily Guerin, "Environmental Groups Say California's Climate Program Has Not Helped Them," *NPR*, February 24, 2017, https://www.npr.org/2017/02/24/515379885/environmental-groups-say-californias-climate-program-has-not-helped-them

excess of supply. A closely related concern is that, while cap-and-trade may set an overall ceiling that total emissions cannot exceed, emissions pricing will be insufficient to mitigate the disproportionate effects of fossil fuel pollution in low-income communities. For many activists, their fight against global warming is part of a larger struggle for environmental justice, against a status quo where communities' exposure to air pollution is strongly correlated with their economic (and, too often, racial) composition; they consider it hypocritical to save the planet as a whole without consideration for the people who are currently most affected by the continued burning of fossil fuels.

Cap-and-trade, in California and elsewhere, has especially been criticized for how a subject entity's GHG emissions reductions are measured, since corporations can meet part of their obligations under the cap-and-trade program by balancing out emissions from their operations with purchases of offsets, or credits that purport to represent an equivalent reduction in emissions somewhere else that was achieved through the purchaser's investment. (A classic example is investing in a reforestation project.) Many corporations regard offsets as a cost-effective way to reduce their net GHG emissions in the near-term, especially if phasing out emissions from certain parts of their operations is at present prohibitively expensive or technologically infeasible. The issues with the billion-dollar global market for GHG offsets are a very difficult and extensive topic on their own, but the essential problem is that not every offset represents an additional decrease in GHG emissions that would not have occurred otherwise (this quality is called "additionality"), and purchasers do not or cannot always evaluate the credibility of the carbon savings claimed by vendors.[36] Therefore, the value of a significant part of the offsets on the market is questionable at best – while efforts by environmental organizations to

[36] Environmental Defense Fund, "3 Things You Need to Know About the Soaring Voluntary Carbon Market," September 29, 2021, https://www.edf.org/blog/2021/09/29/3-things-you-need-know-about-soaring-voluntary-carbon-market

devise a uniform set of standards for GHG emissions offsets are ongoing, there are still no universally accepted rules to guarantee offsets' credibility.[37] Offsets are highly distrusted for perpetuating environmental injustices: corporations are alleged to buy offsets that have benefits in some far-away place, and then continue releasing pollution in the disadvantaged communities where their operations are located, all while registering an overall decline in their business' emissions. California, in fact, has only allowed entities subject to its cap-and-trade program to compensate for eight percent of their emissions by purchasing offsets (which decreased to four percent in 2021, and will rise to six percent in 2026).[38] Nonetheless, the use of offsets has constituted a major criticism of the program –especially since the majority of offset purchases (75 percent, according to one study) are invested in projects that are located out of state.[39]

This chapter constitutes a summary of the debate on cap-and-trade. Before trying to settle that debate with a real-world analysis of California's program, one must take a more in-depth look at how the program functions and the political process that shaped its inception and subsequent development. Chapter Two presents a discussion of this aspect of the state's cap-and-trade program, starting with an overview of the previous historical uses of emissions pricing that helped inspire policymakers in California.

Chapter Two

California's cap-and-trade program may have only come into effect in 2013, but the policy is fundamentally rooted in the long history of market-based mechanisms being employed to control different environmental pollutants, namely the criteria air pollutants for which nationwide targets are set by the Environmental Protection Agency. (For specificity, the EPA list

[37] EDF, "Voluntary Carbon Market"
[38] California Legislature, Assembly Bill 398, Legislative Session 2017-18, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB398
[39] Justine Calma, "How California Can Make its Cap-and-trade Program More Equitable," *Grist*, July 18, 2018, https://grist.org/article/how-california-can-make-its-cap-and-trade-program-more-equitable/

of criteria air pollutants consists of ground-level ozone, lead, carbon monoxide, particulate matter, sulfur dioxide, and nitrogen dioxide; all of these are in some way released by fossil-fuel driven economic activities and thus are emitted by the same sources as GHGs.)[40] Criteria pollutants are not drivers of global warming, but prolonged exposure to all of them has been linked to serious respiratory and other health problems. Nevertheless, as Paul Steinberg writes in his book *Who Rules the Earth?*, it wasn't long before regulators realized that market-based mechanisms had promise:

> "[M]uch of environmental law and policy can be understood as rules crafted by governments to make companies pay for the full cost of their production processes rather than passing the cost on to the public—in effect internalizing the externality. When companies have to pay for their pollution, the prices of goods created through highly polluting practices rocket upward, consumers shift their purchasing preferences, and producers have to scramble to find cleaner, more socially responsible alternatives."[41]

The earliest examples of this principle in action can be found at the advent of modern environmental policymaking in the United States, as the newly minted EPA, empowered to combat air pollution by the Clean Air Act of 1970, sought novel and effective ways to ensure reductions of industrial pollution emissions.[42] However, Steinberg traces the theory itself to even earlier, to the publication in 1960 of Ronald Coase's iconic paper, "The Problem of Social Cost," (by some accounts, the most widely cited economics paper to this day). Coase's fundamental argument is that rules that clearly allocate property rights to individuals can prove essential for improved efficiency, by allowing everyone to experiment to find the most efficient practices.[43] Most relevant to the question of how best to mitigate air pollution, Coase envisioned a

[40] EPA, "Criteria Air Pollutants," https://www.epa.gov/criteria-air-pollutants
[41] Paul Steinberg. *Who Rules the Earth?* New York: Oxford University Press, 2015; p. 107
[42] Steinberg, p. 111-113
[43] Ronald Coase; The Problem of Social Cost. *Journal of Law and Economics* 1960; 3(1): 1–44

revolutionary new approach for dealing with negative externalities, which would ultimately become the animating principle behind cap-and-trade. As Steinberg describes it:

> "What if we were to assign property rights for a given amount of pollution— through government-issued pollution permits, for example—and gave the power to the businesses themselves to buy and sell those rights? Those who can afford to change would sell permits to those who can't; the latter would be eager to pay for the right to pollute. This bargaining process would reduce pollution at a lower cost than is possible with one-size-fits-all regulations."[44]

In the years after the publication of Coase's paper, other academics would go on to more directly link his theory to environmental regulations, and his work would ultimately directly influence Paul DeFalco, administrator of the EPA's San Francisco office, who was in charge of writing the regulations to implement the Clean Air Act for California. In 1976, DeFalco issued a novel regulation known as the Offset Interpretative Ruling, which was meant to reconcile pollution control with continued economic growth by allowing companies to expand their operations as long as they reduced pollution elsewhere in their facilities "by a greater than one-to-one ratio."[45] Inspired by California's example, Congress allowed for offsets in the Clean Air Act Amendments of 1977, and the EPA subsequently allowed offsetting not just within one company's operations, but across different entities, thus creating the first system of tradeable emissions permits.[46]

The first major test of market-based mechanisms came in the late 1970s, when the EPA began its phaseout of leaded gasoline. Tetraethyl lead had been widely added to gas since the 1920s, despite warnings from experts about its extreme toxicity.[47] What amounted to a poisoning of entire generations went unaddressed until the EPA, under the authority of the Clean Air Act,

[44] Steinberg, p. 112
[45] Steinberg, p. 113-114
[46] Steinberg, p. 114
[47] Steinberg, p. 95-96

began issuing permits to oil refineries to allow them to emit a fixed amount of lead.[48] Since the total amount of permits was fixed, the EPA effectively established a cap on lead emissions; holders of permits were subsequently given the right to buy and sell permits that went unused to each other. After a few years, the cap began to be reduced to force cumulative emissions to decline faster. The advantage of this cap-and-trade mechanism over a strict regulation was that firms had the flexibility to find the most efficient way to reduce their lead emissions; moreover, "rather than simply reach the mandated level of pollution control and then stop, as is the norm with traditional approaches to environmental policy, the tradable permits gave firms an [economic] incentive to keep going."[49] The result was that by the late 1980s, after only ten years, the percent of American children with elevated concentrations of lead in their bloodstream decreased from nine in ten to one in ten, and this remainder was almost entirely due to other sources of lead exposure.[50] The EPA would ultimately issue a comprehensive ban on leaded gas in 1996.[51]

It would be with another federal program, the Acid Rain Trading Program, that, according to Steinberg, cap-and-trade "came into its own."[52] Acid rain, or precipitation with an abnormally low pH, is caused by emissions of sulfur dioxide (SO_2), for which burning coal is primarily responsible. While rarely even mentioned in the news today, acid rain was once (along with ozone depletion) regarded as one of the greatest manmade threats to global ecosystems, before global warming began to receive significant public attention. Following the Clean Air Act Amendments of 1990, the EPA began to devise rules to reduce emissions of SO_2, aiming to

[48] Steinberg, p. 98
[49] Steinberg, p. 98
[50] Steinberg, p. 98
[51] Steinberg, p. 115
[52] Steinberg, p. 115

reduce annual emissions to 50 percent of 1980 levels by 2000.[53] Similar to its program for leaded gas, the EPA distributed a finite number of tradeable permits for SO_2, set a penalty starting at $2,000 per ton for any emissions in excess of a corporation's permits, and let regulated corporations find the most efficient method to reduce their emissions while allowing them to buy additional permits to compensate for processes that could not be phased out as quickly.[54] Enforcement began in 1995 for the 263 most SO_2-intensive generating units at 110 predominantly coal-fired power plants, with the program expanding to cover practically all other SO_2-producing plants by 2000.[55] By all accounts, the Acid Rain Trading Program has proved one of the most successful pollution control initiatives in the history of the EPA, having met its 2000 goal and then some. Nationwide, EPA data shows a 94 percent decrease in atmospheric SO_2 from 1980 to 2020.[56] According to Harvard economist Robert Stavins, whose research helped lay the groundwork for the program, not only did the program meet its goal and then some, but "total abatement costs have been significantly less than what they would have been in the absence of the trading provisions."[57] Stavins writes that making use of the market resulted in annual savings of $1 billion, compared to the cost of the command and control approach that was initially considered.[58]

Furthermore, the Acid Rain Trading Program provides an example for how market-based mechanisms can avoid creating environmental injustice by concentrating pollution in low-income communities or communities of color, demonstrating that equity need not inherently be sacrificed for efficiency. An analysis of over 2,000 polluting facilities subject to the program,

[53] Robert Stavins; What Can We Learn from the Grand Policy Experiment? Lessons from SO_2 Allowance Trading. *Journal of Economic Perspectives* 1998; 12(3): 69–88; p. 70
[54] Stavins 1998, p. 71
[55] Stavins 1998, p. 70
[56] EPA, "Sulfur Dioxide Trends," https://www.epa.gov/air-trends/sulfur-dioxide-trends
[57] Stavins 1998, p. 71
[58] Stavins 1998, p. 71

over a 14-year period, finds a significant negative correlation between the percentage of black or Hispanic residents in a community and an increase in SO_2 emissions concentrated in that community. There was also no significant correlation between low income level of a community and increased concentration of SO_2 emissions.[59] In fact, "the [Acid Rain Trading Program] pollution market, it seems, may play a role in remedying existing environmental inequities."[60] Concerns about equitable distribution of pollution reduction benefits will prove to be a recurring theme in the debate about market-based mechanisms; this dimension is critical to understanding the controversies at the heart of carbon pricing in California. Regarding the specific history of cap-and-trade in California, as will be discussed later, concerns about environmental inequity were top of mind for the state's policymakers from the start.

California's cap-and-trade program may be the most well-known use of market-based mechanisms to address GHG emissions, but it actually was not unique, or even the first such program in the United States. Spurred by growing public awareness of global warming and the Bush Administration's then-recent decision not to join the international Kyoto Protocol, Massachusetts and New Hampshire began experimenting with cap-and-trade as early as 2001-2002, and this quickly spurred discussion of broader collaboration on the subnational level, in the hope that states might act when the federal government would not.[61] By 2005, extensive negotiations had led seven northeastern states to agree to form a regional cap-and-trade program that would allow emissions permits to be traded across state lines, known as the Regional Greenhouse Gas Initiative (RGGI). The initiative entered into force on January 1, 2009, with ten

[59] Evan Ringquist; Trading Equity for Efficiency in Environmental Protection? Environmental Justice Effects from the SO_2 Allowance Trading Program. *Social Science Quarterly* 2011; 92(2): 297–323; p. 321
[60] Ringquist 2011, p. 321
[61] Barry Rabe; The Durability of Carbon Cap-and-trade Policy. *Governance* 2016; 29(1): 103–119; p. 114

states participating (most notably, New York).[62] While for a long time after that no new states joined, the coalition has recently seen renewed vitality with Virginia joining in 2021,[63] Pennsylvania set to join in 2022,[64] and North Carolina also having expressed interest[65] (New Jersey left in 2011 and rejoined in 2018).[66] Data from the RGGI states shows that, from 2008-2019, power sector CO_2 emissions fell 47 percent (90 percent faster than in the rest of the country); combined GDP grew 47 percent, outpacing the rest of the country by 31 percent.[67] Cap-and-trade in these states has brought $5.7 billion of benefits from improved health and productivity due to reduced air pollution.[68]

There are some critical differences between RGGI and California's program – in particular, RGGI only applies to the power sector, or about 20 percent of GHG emissions in the participating states,[69] with fossil fuel-fired electricity producers with a capacity of over 25 megawatts subject to the initiative.[70] And of course, RGGI is a multistate coalition that has to navigate the disparate interests of its constituent states, which naturally complicates any comparison to California's experience. However, RGGI still stands as a clear example of a GHG emissions pricing system with political durability and even potential for expansion, and this can be attributed to several key decisions by policymakers. First, while under previous emissions

[62] Rabe 2016, p. 113-115
[63] Regional Greenhouse Gas Initiative, "RGGI States Welcome Virginia as its CO_2 Regulation is Finalized," July 8, 2020, https://www.rggi.org/sites/default/files/Uploads/Press-Releases/2020_07_08_VA_Announcement_Release.pdf
[64] Harrison Cann, "Pennsylvania Takes the Final Step Toward Joining RGGI," *City & State PA*, September 1, 2021, https://www.cityandstatepa.com/politics/2021/09/pennsylvania-takes-final-step-toward-joining-rggi/364479/
[65] Sierra Club North Carolina, "North Carolinians Urge Cooper to Make RGGI Membership a Priority," April 11, 2022, https://www.sierraclub.org/north-carolina/blog/2022/04/north-carolinians-urge-cooper-make-rggi-membership-priority
[66] Phil McKenna, "New Jersey to Rejoin East Coast Carbon Market, Virginia May be Next," *Inside Climate News*, January 29, 2018, https://insideclimatenews.org/news/29012018/cap-and-trade-carbon-emissions-regional-greenhouse-gas-initiative-rggi-new-jersey-virginia-climate-change/
[67] Acadia Center, "The Regional Greenhouse Gas Initiative: Ten Years in Review," 2019, https://acadiacenter.org/wp-content/uploads/2019/09/Acadia-Center_RGGI_10-Years-in-Review_2019-09-17.pdf
[68] Acadia Center, "RGGI: Ten Years in Review"
[69] David Vogel. *California Greenin'*. Princeton, NJ: Princeton University Press, 2018; p. 216
[70] Regional Greenhouse Gas Initiative, "Elements of RGGI," 2022, https://www.rggi.org/program-overview-and-design/elements

trading systems, the initial stages had seen a significant fraction of emissions permits allocated to corporations for free, all the states participating in RGGI agreed to distribute either all or a large majority of their permits through auctions from the very beginning. This move followed strong pressure from environmental activists; by requiring corporations to pay for their initial accrual of permits, RGGI not only incentivized corporations to price in the social costs of their emissions but immediately began generating substantial revenue, which could be used to invest in various green initiatives. Furthermore, RGGI began operation with a price floor that set a minimum price for emissions permits; while the floor ensured that significant revenue was raised, it also started out low enough (less than $2 per permit) that the private sector could adapt to the introduction of the program without too much disruption.[71] Prices could subsequently be increased gradually to ensure disruption remained minimized. Finally, RGGI was designed to build and maintain constituent support through the effective distribution of revenues from permit auctions. States took care to especially promote the use of the new windfall for small-scale programs with direct impact on individuals and communities – for example, grants for improved energy efficiency, industrial retrofits, and weatherization. Despite not being universally followed, by and large RGGI states kept to the operating principle that revenues should only be spent on climate-related efforts, not added to general funds or used for deficit reduction.[72] (This is important because California has faced criticism over some of the projects that have been awarded funding from the cap-and-trade program, which certainly didn't help politically.)

These three examples constitute the most important domestic influences on AB 32 and the subsequent development of California's cap-and-trade program. However, it must also be noted that California was heavily influenced by experimentation with cap-and-trade

[71] Rabe 2016, p. 115-117
[72] Rabe 2016, p. 117

internationally, especially by the Emissions Trading System (ETS) in the European Union, which began implementation in 2001.[73] Intended as Europe's plan to meet the goals of the Kyoto Protocol, ETS was established as the world's largest cap-and-trade program for GHG emissions, in terms of covered economic activity, and indeed remains so today.[74] European officials traveled to California to advise lawmakers as AB 32 was being passed, and CARB representatives would later visit Brussels to observe Europe's experience when devising California's cap-and-trade program.[75] According to a 2017 paper by Bang et al, having had the chance to observe the problems faced by ETS, "CARB put a lot of weight on ensuring that the data and rules were right before implementation of the carbon market began."[76] These problems consisted of "overallocation of permits, generous rules for offsets, and windfall profits for emitters," which all combined to keep carbon prices low.[77] CARB was determined to avoid these pitfalls in its own rulemaking process; Chapter Three evaluates how successful their efforts were.

If one turns one's analysis specifically to the history of the development of cap-and-trade within California, one finds it is ultimately a story of compromise and coalition-building between differing interests that were often in conflict with each other. Bang et al write that, as much as California tried to learn from other places that had experimented with cap-and-trade programs, the state quickly "proceeded largely into uncharted territory, because it designed and implemented rapidly a system that was much more complex and bespoke to California conditions" than anything that had come before.[78] While the cap-and-trade program was renewed

[73] Guri Bang, David G. Victor, and Steinar Andresen; California's Cap-and-Trade System: Diffusion and Lessons. *Global Environmental Politics* 2017; 17 (3): 12–30; p. 12
[74] European Commission, "Climate Action," https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_en
[75] Bang et al 2017, p. 19
[76] Bang et al 2017, p. 19
[77] Bang et al 2017, p. 20
[78] Bang et al 2017, p. 26

on a bipartisan basis in 2017, the debate about the program in the state's political discourse remains so contentious that a casual observer would be forgiven for concluding that none of the key stakeholders have gotten what they wanted, but only the absolute minimum they could accept. Indeed, in the years following the passage of AB 32, there were several occasions where the continued survival of carbon pricing in California seemed in serious doubt. And yet, nevertheless, California met its initial target under AB 32 – to reduce GHG emissions to 1990 levels by 2020 – four years in advance.[79] Criticisms that cap-and-trade would damage economic growth or make California's businesses uncompetitive have not, upon evaluating the evidence, come to pass. (Chapter Three presents a more detailed analysis of the real-world economic effects of the cap-and-trade program.) The remainder of this chapter will endeavor to describe how cap-and-trade in California came to be and how it has persevered, despite the obstacles it has faced.

In his book *California Greenin'*, David Vogel notes that California's long history of ambitious and innovative environmental policymaking provided the foundation for the state to lead the way on tackling GHG emissions. Vogel cites long-standing factors rooted in California's history – "perceived threats to the state's attractive and vulnerable environment," "strong civic support for environmental protection," "a divided business community that has made possible alliances between environmental activists and business firms," and "the growth of the state's administrative capacity" – as having contributed to the political moment that made AB 32 possible.[80] There certainly are concrete examples of that history having a direct role in the successful passage and enactment of AB 32. Perhaps most notable is California's groundbreaking efforts at controlling air pollution from industrial and vehicular sources in the

[79] CARB, "Climate Pollutants Fall Below 1990 Levels For First Time," July 11, 2018, https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time
[80] Vogel, p. 189

1950s and 1960s, necessitated by the extreme pollution in Los Angeles and other cities – including the enactment of the world's first emissions standards for vehicles in 1964.[81] California developed a highly sophisticated state bureaucracy for combating air pollution that served as a model for the country (as one air pollution control official in New York City remarked about his Los Angeles counterparts in 1962, "they investigate – we check").[82] Ultimately, this led to California being granted the unique privilege of a waiver under the 1970 Clean Air Act that allowed the state to set its own air pollution rules, tougher than those at the federal level.[83] All this resulted in the California Air Resources Board (CARB) developing unparalleled expertise in the highly technical arena of drafting and enforcing emissions rules. Since its establishment in 1967, CARB has grown into the largest state-level environmental regulatory agency in the country, second in prestige only to the EPA.[84] This became relevant for AB 32 because it made legislators feel comfortable granting CARB such wide-ranging authority in drafting rules to meet the targets in the bill's text. If the legislature had not had that much trust in CARB to methodically find the best combination of strategies for achieving emissions reductions, they might have felt the need to mandate a particular strategy in the text of AB 32, which would have created disagreements that might have prevented the bill from being passed.

On the other hand, there were certainly unique circumstances shaping AB 32. Indeed, one can see the evidence for this in the fact that, as Vogel writes, California's policies to reduce GHG emissions were more comprehensive and far-reaching in "scope, diversity, and economic impact" than the state's previous efforts targeting air pollution or other environmental issues.[85] In several key ways, there was a critical window of opportunity in the years leading up to 2006 that

[81] Vogel, p. 5, p.173-174
[82] Vogel, p. 163
[83] Vogel, p. 176-180
[84] Vogel, p. 15-16, p. 176
[85] Vogel, p. 189

enabled California to take action targeting GHG emissions. These dynamics included a growing public awareness of global warming and an increasing desire on the part of the public for the state government to act, driven by the increasingly evident threat that global warming posed specifically to the lives and livelihoods of Californians,[86] and heightened by the federal government's failure to join the Kyoto Protocol in 2001.[87] The multifaceted threat to California was brought into sharp focus by two highly influential reports from the Union of Concerned Scientists, one in 1999 and one in 2004, which were heavily cited by the legislative backers of AB 32.[88] As a result, polling in 2005 showed that a majority of Californians considered global warming a "very serious threat to the state's future economy and quality of life," and two-thirds wanted the state to take action independently of the federal government.[89] Taking advantage of this political moment, on United Nations World Environment Day in 2005, then-Governor Arnold Schwarzenegger signed an executive order requiring the state to reduce its GHG emissions to 2000 levels by 2010 and to 80 percent below 1990 levels by 2050.[90] On the legislative front, AB 1493, the first law anywhere in the world to mandate reductions of GHG emissions from vehicle tailpipes, was passed and signed into law in 2002.[91] (AB 1493 took advantage of California's waiver under the Clean Air Act to set its own emissions standards independently of the federal government, directing CARB to develop regulations for GHG emissions as it had previously done for the criteria pollutants that constituted the traditional targets of clean air regulation.) Authored by then-Assemblywoman Fran Pavley, who would later also co-author AB 32, it set a crucial precedent for California climate policy: AB 1493 delegated

[86] Vogel, p. 200-207
[87] Vogel, p. 201
[88] Vogel, p. 200, p. 206
[89] Vogel, p. 206-207
[90] Vogel, p. 206
[91] California Legislature, Assembly Bill 1493, Legislative Session 2001-02, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020AB1493

to CARB the technical work of developing regulations to achieve the emissions targets enumerated in the bill (in fact, the bill was only eight pages long), an approach that AB 32 would also adopt.[92]

Even so, despite the opportune environment, some concessions (in particular to placate concerns from business) and a broad coalition were critical to getting AB 32 over the finish line. The governor was given the power to block implementation of the bill if it would have detrimental economic consequences;[93] also, as mentioned previously, to avoid disputes over the precise method of reducing GHG emissions, the bill did not explicitly require CARB to employ carbon pricing or any other policy. On the other hand, supporters of AB 32 built a coalition that, in addition to all the prominent environmental organizations like Sierra Club and Natural Resources Defense Council, included an eclectic "bootleggers and Baptists" alliance of 49 cities, religious groups, big-city investors, and unions representing the building and construction sectors.[94] They were able to do this by stressing the unique threats that global warming posed to California's economy, public health, and indeed way of life – and, on the other side, by emphasizing the economic opportunities offered by new standards that promised to promote investment in clean energy.[95] Thus, while groups like the California Chamber of Commerce and the California Business Roundtable opposed the bill, the backers of AB 32 were able to win over certain voices in the business community and thus (somewhat) neutralize conservative opposition.[96] AB 32 even had the support of three quarters of California voters at the time of

[92] Vogel, p. 201-203
[93] Vogel, p. 207
[94] Vogel, p. 207-208
[95] Vogel, p. 207-208
[96] Vogel, p. 208-209

passage.[97] That being said, although AB 32 was supported and ultimately signed into law by the Republican governor, only one Republican legislator voted for the bill.[98]

The passage of AB 32 was only the beginning of the challenges that cap-and-trade in California has faced up to the present day. Fossil fuel companies (mostly from out of state) attempted to delay the enactment of cap-and-trade by donating heavily to a 2010 ballot initiative, Proposition 23, that would have blocked implementation of AB 32 until California's unemployment rate, still high following the 2008 recession, dropped below 5.5 percent. As Vogel puts it, "never before had business mounted such a sweeping challenge to a major state environmental initiative."[99] However, Prop 23 was rejected by voters by double digits, undoubtedly due to the concerted organizing of environmental organizations, supported by Silicon Valley venture capital that had increasingly come to recognize the economic potential of investments in a clean energy transition. Even some of the loudest voices opposing the initial passage of AB 32 actually took a neutral stance on Prop 23, including the state Chamber of Commerce and the massive oil industry trade group Western States Petroleum Association (WSPA), having also recognized the promise of investments spurred by cap-and-trade.[100]

By 2012, CARB had drafted rules for a statewide cap-and-trade program, that would begin with energy-related emissions and gradually expand to cover nearly the entire state economy. Set to go into effect the following year, the program would cap GHG emissions and require annual reductions of two percent in its first two years of implementation, and three percent from 2015 to 2020. Mindful of concerns about transition costs for businesses, at the outset of the program CARB distributed permits for as much as 90 percent of subject firms'

[97] Vogel, p. 209
[98] Vogel, p. 209
[99] Vogel, p. 211
[100] Vogel, p. 211-213

cumulative emissions for free rather than through auction.[101] However, the California Chamber of Commerce filed suit to block the implementation of cap-and-trade, arguing that the program was effectively a new tax, and thus (as required by California law since the passage of Proposition 13 in 1978) had to be approved by a two-thirds majority in both houses of the legislature, while AB 32 had been passed with only a simple majority. This suit was unsuccessful, but, seeking to avert a future challenge on those grounds, when it came time to renew cap-and-trade past 2020 the program's legislative backers endeavored to craft a new bill that could pass the two-thirds threshold.[102] Although California was on track to meet the 2020 goal set in AB 32, by that time the state had more long-term GHG emissions reduction targets as well, and needed to ensure its policies were stringent enough to meet them: in 2016, then-Governor Jerry Brown had signed SB 32 (also authored by Fran Pavley, by then a State Senator), in which California committed to a further GHG emissions reduction of 40 percent from 1990 levels, for a new target of 258.6 million metric tons of CO_2-equivalent by 2030.[103]

Securing a two-thirds majority for the bill to extend the authorization of cap-and-trade to 2030, known as AB 398, required further compromise to overcome corporate pro-fossil fuel opposition. However, it was at this time that concerns about environmental justice for low-income communities, and more broadly concerns by grassroots activists that cap-and-trade had gone too far in accommodating big business, most obviously came to the forefront.[104] While AB 398 ultimately passed with the desired two-thirds majority (eight Republican legislators voted in

[101] Vogel, p. 216
[102] Vogel, p. 217, p. 222
[103] California Legislature, Senate Bill 32, Legislative Session 2015-16, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB32
[104] Vogel, p. 223

favor, compared to only one for AB 32),[105] the compromises made to bring about its passage would serve to solidify many grassroots activists' doubts about the cap-and-trade experiment.

Concessions made to business included holding some permits in reserve in order to create a price ceiling on emissions permits, to ensure the carbon price would not rise too high in the event of a price spike.[106] (The cap-and-trade program has also, like RGGI, included a price floor since the start of implementation, this one beginning at $10 per permit and rising by five percent plus the consumer price index annually until 2020.)[107] Companies retained the ability to purchase offsets to cover a small percentage of their mandated emissions reductions, with that percentage set at four and six percent for the periods beginning in 2021 and 2026, respectively.

AB 398 also included a requirement that, starting in 2021, at least half of offsets purchased must demonstrate environmental benefits within California's borders, defined in the bill's text as reduction or avoidance of air or water pollution.[108] This does not, strictly speaking, mean that the offsets must come from actions taken within California – for example, a reforestation project in Oregon near the California border could be feasibly said to have air quality benefits that are felt in both states (see Chapter One for a more in-depth discussion of the controversies surrounding offsets). Other projects that potentially qualify for in-state environmental benefits under the cap-and-trade program may involve emissions from agriculture and livestock, fluorinated gases (chlorofluorocarbons and hydrofluorocarbons) with high global warming potential, or urban forest management.[109] CARB also will continue giving out permits for a significant fraction of subject entities' obligations for free instead of through auction, until

[105] Vogel, p. 223
[106] Vogel, p. 222
[107] California Code of Regulations, 17 CCR §95911
[108] California Legislature, AB 398
[109] CARB, "Direct Environmental Benefits in the State (DEBS)," https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/direct-environmental-benefits

at least 2030. Legislative Democrats also agreed to put a constitutional amendment on the 2018 primary ballot that would require a one-time two-thirds vote in each chamber before cap-and-trade revenues could be disbursed, which Republicans hoped would give them more control over how the funds would be distributed, but that amendment was rejected by over 60 percent of voters.[110]

Even more controversially, emissions from oil refineries were in effect made almost exempt from the program, with California's refineries continuing to receive permits for nearly all their expected emissions for free under AB 398. At least one researcher, Greg Karras at Communities for a Better Environment, has called this particular compromise detrimental to California's long-term climate goals.[111] Finally, in a provision especially lobbied for by the Western States Petroleum Association, a longtime fixture of state politics, local governments and air quality districts (like the South Coast Air Quality Management District for the Los Angeles area) no longer have the power to take regulatory action against individual sources of GHG pollution that are also subject to the cap-and-trade program. Oil and gas producers reportedly insisted on this preemption by arguing it was necessary to protect their ability to plan and invest long-term.[112] However, both of these last two concessions have been the targets of especially fervent criticism from environmental justice groups. Julia May, senior scientist at Communities for a Better Environment, said in a statement: "the cap-and-trade extension was written by the oil industry, is even worse than the current failed program, includes preemptions from local action,

[110] Ballotpedia, "California Proposition 70, Vote Requirement to Use Cap-and-trade Revenue Amendment (June 2018)," https://ballotpedia.org/California_Proposition_70,_Vote_Requirement_to_Use_Cap-and-Trade_Revenue_Amendment_(June_2018)

[111] Jacques Leslie, "Until California Curbs its Oil Refineries, it Won't Meet its Climate Goals," *The Los Angeles Times*, September 11, 2018, https://www.latimes.com/opinion/op-ed/la-oe-leslie-refineries-california-climate-summit-20180911-story.html

[112] Ruairi Arrieta-Kenna, "California Just Got Bipartisan Support to Extend its Cap-and-trade Program to 2030," *Vox*, July 18, 2017, https://www.vox.com/energy-and-environment/2017/7/15/15955756/california-climate-brown-ab398-cap-and-trade

gives away so many free credits we will never meet climate goals, and allows oil refineries to expand indefinitely with no program for just transition to clean energy that is so desperately needed in [environmental justice] communities."[113] RL Miller, president of Climate Hawks Vote, added, "AB 398 began as a Big Oil wish list, and it hasn't improved since then."[114] In the end, while AB 398 had the support of the California Chamber of Commerce and the California Business Roundtable, as well as organizations like Natural Resources Defense Council and Environmental Defense Fund, other major advocacy groups like Sierra Club and California Environmental Justice Alliance declined to support it for these reasons.[115]

It must be said that not every analysis of AB 398 casts it as having made too many compromises to appease the fossil fuel industry. Writing in *Forbes* as AB 398 was being passed, Chris Busch, research director at the nonpartisan thinktank Energy Innovation, notes "the fact is that the oil industry suffered losses on several priority issues."[116] Busch points out that the additional free permits to oil refineries allowed under AB 398 are set to constitute only two percent of the total permits to be issued in 2021-2030. Furthermore, the fossil fuel lobby failed to achieve its key priority of more permissive limits on offset use, with AB 398 decreasing the maximum percentage of obligations that can be met with offsets from the then-current level of eight percent, and adding the requirement that half of offset purchases have direct in-state environmental benefits. The industry's push for a hard ceiling on permit prices of $50 per ton also did not make it into the bill.

---

[113] Climate Hawks Vote, "California: Broad Coalition of Environmental Justice, Climate Groups Oppose Cap-and-trade Bill," July 13, 2017, http://climatehawksvote.com/news/press-releases/california-broad-coalition-environmental-justice-climate-groups-oppose-cap-trade-bill/

[114] Climate Hawks Vote, "Broad Coalition"

[115] Vogel, p. 222-223

[116] Chris Busch, "California's Cap-and-trade Compromise is a Big Step Forward, Not a Win for Polluters," *Forbes*, July 12, 2017, https://www.forbes.com/sites/energyinnovation/2017/07/12/californias-cap-and-trade-compromise-is-a-big-step-forward-not-a-win-for-polluters/?sh=22daefff3ea0

This chapter examines the complicated history of AB 32 and of how California's cap-and-trade program evolved in the years after its passage, incorporating some of the successful elements of RGGI and its other predecessors but also retaining notable differences. These events took place in a broader context of California leaders' desire for the state to lead the way for the rest of the country and the world in its policy response to global warming. Indeed, California policymakers took many other impactful actions in the years since 2006, which are mostly outside the scope of this thesis; however, there is one that bears mentioning. In an executive order issued in 2018, a year after the cap-and-trade renewal and two years after SB 32, then-Governor Brown set an even tougher long-term GHG emissions target: carbon neutrality (net-zero or negative total emissions) by 2045. Immediately hailed as the most ambitious emissions target in the world, it was now even more important for California to use the most effective combination of policies possible in the years going forward.[117] In light of this, the next two chapters will delve into the practical effects of the cap-and-trade program to ascertain whether it is fulfilling its stated goals, beginning with an evaluation of its performance on several economic parameters in Chapter Three.

Chapter Three

As previously discussed, the rationale for cap-and-trade is rooted in the economic theory of externalities, which argues that government action can mitigate a negative externality by raising the price of the societally harmful activity to ensure that the market reflects its social cost as well as its individual cost. Once the market sends a price signal that incorporates the true cost of an activity that imposes a negative externality, so the reasoning goes, any rational economic actor would respond by reducing their production of the externality. Because of this, the question

[117] David Roberts, "California Gov. Jerry Brown Casually Unveils History's Most Ambitious Climate Target," *Vox*, September 12, 2018, https://www.vox.com/energy-and-environment/2018/9/11/17844896/california-jerry-brown-carbon-neutral-2045-climate-change

of whether cap-and-trade has been successful in California is most fundamentally an economic one.

There are three relevant parameters when evaluating the economic impact of California's cap-and-trade program. The first, most basically, is whether the program has been effective at its stated objective: to reduce GHG emissions in accordance with the state's legally binding targets. I isolate the effect of the cap-and-trade program over the years 2013-2020, by presenting data that separates the impact of cap-and-trade from California's other climate policies (namely, command and control regulations), and by comparing California's historical GHG emissions reductions to trends in the rest of the country; I further discuss the conclusions of some notable research papers on this much-studied topic in the last several years. The second economic parameter looks beyond effectiveness to examine efficiency: it asks how effective cap-and-trade has been given its cost constraints. I will explore cap-and-trade both in terms of its macroeconomic cost to California, and in terms of its cost-effectiveness compared to regulatory measures. Finally, the third parameter concerns how the costs of cap-and-trade are distributed; specifically, whether the costs of the cap-and-trade program have been disproportionately felt by low-income Californians. I will likewise compare cap-and-trade to California's climate regulations in this respect.

Since a major part of this analysis consists of isolating the effect of cap-and-trade from other policies, to try to ascertain the value of a free-market mechanism compared to the command and control approach that many of cap-and-trade's critics would likely prefer, it bears giving some further detail about the regulatory measures that California's cap-and-trade program is to be measured against. Two separate regulations in particular are comparably critical to California's emissions reduction strategy: the Renewable Portfolio Standard (RPS) and the Low-

Carbon Fuel Standard (LCFS). Under RPS, California requires power companies to source an increasing percentage of their electricity retail sales from renewables.[118] The regulation was established in 2002 under SB 1078, which set an initial target of 20 percent of retail sales from renewable sources by 2017.[119] Under SB 350 (2015), a new target of 50 percent renewable by 2030 was set;[120] SB 100 (2018) strengthened this to 60 percent renewable by 2030.[121] RPS is jointly administered by the California Energy Commission (CEC) and the California Public Utilities Commission (CPUC), and applies to investor-owned utilities like Southern California Edison or Pacific Gas and Electric, as well as to more small-scale providers like community choice aggregators.

LCFS does much the same thing as RPS, except for transportation rather than electricity. The regulation requires refineries and distributors to meet progressively tightening targets for reducing the life cycle carbon intensity (CO_2-equivalent per unit of fuel energy) of transportation fuels sold in California.[122] A key way that California ensures LCFS is met is by requiring a certain percentage of biofuels, which are considered a renewable energy source, to be added to the state's fuel mix. CARB first proposed LCFS in 2008 as part of the first AB 32 scoping plan, following a 2007 executive order directing the state to address carbon intensity of fuels, and subsequently began implementation in 2011, with the aim to reduce average carbon intensity of transportation fuels in California by about one percent annually. LCFS has a target of a 10

[118] California Public Utilities Commission, "Renewable Portfolio Standard (RPS) Program," https://www.cpuc.ca.gov/rps/
[119] California Legislature, Senate Bill 1078, Legislative Session 2001-02, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200120020SB1078
[120] California Legislature, Senate Bill 350, Legislative Session 2015-16, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB350
[121] California Legislature, Senate Bill 100, Legislative Session 2017-18, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180SB100
[122] CARB, "Low Carbon Fuel Standard," https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard/about

percent reduction in carbon intensity from 2010 levels by 2020, and (since 2018) a 20 percent reduction by 2030.[123]

An interesting further dimension to both of these policies is that, while they function primarily through a command and control approach (and thus can be categorized as such for the purposes of comparison to the cap-and-trade program), RPS and LCFS do have a market-based component: both allow subject entities to purchase credits as part of their compliance obligations.[124] While these regulations are not enforced through cap-and-trade programs, as there is no cap on the number of credits available for purchase in a given period, RPS and LCFS do rely on what are essentially state-supported emissions offset markets to achieve at least part of their goals. Also in this category of "hybrid" policies is California's regulations targeting emissions from vehicle tailpipes, which CARB first instituted in 1990 through its Low Emissions Vehicle regulations, making use of California's Clean Air Act waiver. These measures required car manufacturers to progressively reduce their vehicle fleets' emissions of criteria pollutants (and therefore, indirectly spurred reductions in GHG emissions as well), with a mandate that a certain percentage of their fleets consist of zero-emissions vehicles, and allowed for trading of credits as one compliance option. In 2002, AB 1493 expanded CARB's purview to allow for direct regulation of tailpipe emissions of GHGs in addition to criteria pollutants. CARB adopted the most recent form of the LEV regulations in 2012 as part of its Advanced Clean Cars Program, including the Zero-Emissions Vehicle regulation requiring car manufacturers to

[123] Renewable Fuels Association, "The California LCFS and Ethanol: A Decade of Reducing Greenhouse Gas Emissions," Report, May 2021, https://ethanolrfa.org/file/9/RFA-LCFS-Report_PDF.pdf
[124] CARB, "FAQ Cap-and-trade Program," https://ww2.arb.ca.gov/resources/documents/faq-cap-and-trade-program#ftn18

increase their production of all-electric and hybrid vehicles, which likewise gives subject entities the option of trading ZEV credits.[125]

California also employs "pure" command and control policies as part of its emissions reductions strategy under AB 32. Like RPS and LCFS, these policies began implementation before 2013, meaning they have been enforced simultaneously with cap-and-trade and thus make for a useful comparison; furthermore, CARB has stated in its scoping plans that it considers all of these policies as part of its policy toolkit to meet California's climate targets.[126] Perhaps the most enduring and far-reaching is California's nation-leading energy efficiency rules, which have been a hallmark of state environmental policy for decades, and continue to be regularly updated into the present day. These rules are enforced by the CEC (for buildings and appliances) and the CPUC (for utility companies). According to the CPUC, thanks to California's commitment to energy efficiency, the state's per capita energy use has remained flat since the 1970s, while it increased 33 percent in the rest of the country.[127]

CARB further promotes reductions in emissions from vehicles through its Sustainable Communities Program. Under the authority of the 2008 Sustainable Communities and Climate Protection Act (SB 375), CARB sets regional goals to reduce GHG emissions from passenger vehicles, with the next target date currently set for 2035.[128] The state is divided into 18 metropolitan planning organization (MPO) regions, who must present CARB with a plan to meet

[125] CARB, "Zero-Emission Vehicle Program," https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program/about
[126] CARB, "AB 32 Climate Change Scoping Plan"
[127] CPUC, "Energy Efficiency," https://www.cpuc.ca.gov/energyefficiency/#:~:text=The%20CPUC%20regulates%20ratepayer%2Dfunded,within%20California%20using%20ratepayer%20funds.
[128] California Legislature, Senate Bill 375, Legislative Session 2007-08, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=200720080SB375

the GHG emissions target for their region through transportation and land use planning.[129] While CARB has the power to approve the plans submitted by MPOs, and to require the MPO to submit an alternate proposal if the original one is rejected, it does not actually have the power to enforce their enactment (which would be done via local zoning decisions). However, SB 375 outlines incentives for developers and local planning authorities to follow through on their plans, by creating exemptions to California's wide-ranging environmental review requirements for development projects that meet Sustainable Communities Program goals.[130]

Having established what the California cap-and-trade program is to be compared to, one can turn the discussion to an analysis of how the program has performed in real life. Towards this end, the natural place to start is with the question of the program's effectiveness. In contrast to efficiency, effectiveness does not consider cost; this parameter simply asks how well the program has performed at its objective of reducing GHG emissions. When evaluating this question, the first and foremost observation has to be that California met its target under AB 32 – to reduce GHG emissions from their peak in 2004 to the 1990 level of 431 million metric tons of CO_2-equivalent, by the deadline of 2020 – four years ahead of schedule. From this alone, it seems, one can call the California cap-and-trade program an impressive success. CARB certainly seems to think so, since in its 2017 Scoping Plan, where the agency lays out its plan for achieving California's future climate targets, the cap-and-trade program is projected to be the single biggest source of GHG emissions reductions (about 38 percent) in the period 2021-2030 – especially notable since meeting California's 2030 goal will require a much sharper rate of

[129] CARB, "Sustainable Communities and Climate Protection Program," https://ww2.arb.ca.gov/our-work/programs/sustainable-communities-climate-protection-program/about
[130] CARB, "Sustainable Communities"

emissions decline compared to the 2020 goal.[131] However, to fully qualify the observation that California met its initial target, two questions must be addressed. First, one must ask how well the cap-and-trade program enforces its own rules (for context), and subsequently one must examine how much the emissions decline in California can be attributed directly to the impact of its cap-and-trade program.

In 2007, CARB adopted a comprehensive enforcement mechanism known as the Mandatory Reporting of Greenhouse Gas Emissions Regulation (MRR), following AB 32's directive to enact rules for reporting and verification of statewide GHG emissions.[132] MRR requires certain entities that emit over 10,000 metric tons of CO_2-equivalent a year, and others with any level of emissions, to report their GHG emissions[133] and to have their submitted emissions data verified by an independent third party from CARB's approved list. MRR is incorporated into the California Code of Regulations, and CARB is empowered to impose fines for failure to report emissions. The regulations specify that "each day or portion thereof that any report required by this article remains unsubmitted, is submitted late, or contains information that is incomplete or inaccurate is a single, separate violation;" and that "each metric ton of [CO_2-equivalent] emitted but not reported as required by this article is a separate violation."[134]

Entities subject to cap-and-trade must present enough permits and/or offsets (up to the permitted percentage of total emissions obligations) to cover their emissions for each compliance period, of which there have been three between 2013 and 2020, each lasting two or three years. This requirement is rigorously enforced: an entity that fails to meet a compliance period

[131] CARB, "California's 2017 Climate Change Scoping Plan," November 2017, p. 28, https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf
[132] CARB, "Mandatory Greenhouse Gas Emissions Reporting," https://ww2.arb.ca.gov/our-work/programs/mandatory-greenhouse-gas-emissions-reporting/about
[133] California Code of Regulations, 17 CCR § 95101
[134] California Code of Regulations, 17 CCR § 95107

deadline, or to present enough permits and/or offsets by that deadline, is immediately assessed a penalty of four times the number of permits that are still owed.[135] According to CARB's website, only one entity has ever been given this penalty, and it ultimately complied with its obligations.[136] Overall, CARB has reported compliance rates of near 100 percent at each relevant deadline.[137] CARB also requires offsets to undergo third-party verification from a list of accredited verifiers to guarantee the veracity of purported GHG emissions savings.[138] This verification procedure ensures that offsets meet CARB's standards for permanence (for example, reforestation projects must ensure carbon savings for a minimum of 100 years), as well as for additionality, so that emissions reductions from offsets will be greater than what would have been achieved anyway under normal practices.[139]

Furthermore, not only have subject entities only been allowed to use offsets to meet eight percent of their obligations for the entirety of the past decade, but the past compliance periods saw an even smaller percentage of obligations actually met through offsets: 4.39 percent for the first compliance period (2013-2014), 6.36 percent for the second (2015-2017), and 6.96 percent for the third (2018-2020).[140] If one thinks of offsets as a corporate giveaway that allows businesses to avoid making serious efforts to phase out GHG emissions from their operations (since, at the very least, offsets represent the "easy way" to meet one's obligations), then this data is strong evidence that the cap-and-trade program is not simply successful because its requirements aren't hard to satisfy. To be able to consistently submit more permits than needed

[135] CARB, "FAQ"
[136] CARB, "FAQ"
[137] CARB, "FAQ"
[138] CARB, "Offset Verification," https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program/offset-verification
[139] CARB, "Compliance Offset Protocol: US Forest Projects," June 25, 2015, p. 26-31, https://ww2.arb.ca.gov/sites/default/files/cap-and-trade/protocols/usforest/forestprotocol2015.pdf
[140] CARB, "Cap-and-trade Program Data" (under "Compliance Reports"), https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program/cap-and-trade-program-data

to meet their obligations under cap-and-trade (as opposed to purchasing offsets to make up the difference), even as the total number of permits on the market decreases annually, it follows that corporations must make genuine effort to modify their operations so that they need to emit less GHGs than before. If corporations are going above and beyond what the cap-and-trade program requires of them, then there must be some incentive for them to do so. The question then becomes, of course, to what extent this incentive can be attributed to the cap-and-trade program itself.

Public data provided by CARB may provide a way to isolate for the impact of cap-and-trade on California GHG emissions. Since the cap-and-trade program sets a cap on about 85 percent of the state's emissions that decreases by a pre-determined amount annually, with the precise amounts laid out in the California Code of Regulations (measured in millions of permits, which equates to millions of metric tons of CO_2-equivalent),[141] one can calculate the annual percent decrease in capped emissions. One can further compare these figures to the year-on-year percent change in California's overall GHG emissions, from data also provided by CARB.[142] Calculating these percent changes, one finds that the cap decreased 1.9 percent from 2013 to 2014, and then decreased by over three percent over all of the other four intervals between 2015 and 2019 (data for 2014-2015 is excluded because the cap jumped significantly over that interval, coinciding with the expansion of the program to cover transportation fuels and natural gas). 2018-2019, for example, saw the highest decrease at 3.35 percent. The percent changes in overall GHG emissions, on the other hand, were smaller; all but one interval saw decreases of less than three percent (and only 2015-2016 saw a decrease greater than two percent). The interval 2017-2018 actually saw a small increase in emissions of 0.16 percent.

[141] California Code of Regulations, 17 CCR § 95841
[142] CARB, "Current California GHG Emission Inventory Data," https://ww2.arb.ca.gov/ghg-inventory-data

Assuming that the overall change in California GHG emissions reflects an average of the effects of all the state's disparate climate policies, this finding could actually suggest that the other policies are underperforming compared to cap-and-trade. This conclusion, of course, ignores that cap-and-trade does not impact all sectors equally, and does not negate that the program certainly could be made stronger to improve its performance in the sectors where urgent action is most needed: while emissions from electricity production have seen a steep decline since 2013, transportation and industrial emissions have been relatively flat, and both now exceed emissions from the power sector, together comprising 61 percent of California's 2019 GHG emissions.[143] The single biggest source of industrial emissions in recent years – refineries – are functionally exempt from cap-and-trade. Nevertheless, this is evidence that the cap-and-trade program is actually capable of doing what it was meant to do, and is playing an impactful role in the state's broader climate strategy, perhaps even an outsized role compared to policy alternatives.

A final test of the California cap-and-trade program's effectiveness comes from asking what was happening in the rest of the country, in the critical years of 2013-2019 during which the program met its 2020 goal. While one can separate the effect of cap-and-trade from the effects of other California policies, there still remains the question of whether the real driver of California's emissions reduction may have been broader trends (either in the economy or in policy) in the nation as a whole. Using data from the EPA, which provides an annual breakdown of national GHG emissions (in millions of metric tons of CO_2-equivalent), one can calculate the percent change from 2013 to 2019.[144] The previously mentioned annual California emissions

[143] CARB, "California Greenhouse Gas Emissions for 2000 to 2019," July 28, 2021, p. 7-8, https://ww2.arb.ca.gov/sites/default/files/classic/cc/inventory/2000_2019_ghg_inventory_trends_20220401.pdf
[144] EPA, "Climate Change Indicators: US Greenhouse Gas Emissions," April 2021, https://www.epa.gov/climate-indicators/climate-change-indicators-us-greenhouse-gas-emissions

data from CARB can likewise be used to calculate percent change over that interval. Doing this calculation, one finds that for 2013-2019, United States GHG emissions declined 3.05 percent, while California GHG emissions declined 6.53 percent. Clearly, if California's emissions decreased twice as much as the entire country's, that disproves the suggestion that California's emissions reductions cannot be attributed to state policy but rather to movement on the national level.

The conclusion that the cap-and-trade program is having a real impact on California's GHG emissions decline is perhaps a surprising one; judging by the existing literature on the program, it is certainly controversial. Criticisms of cap-and-trade as ineffective abound, with the central argument being that its price signal is too weak to change subject entities' behavior enough to meet California's long-term emissions targets. A key reason given for the price of permits being too low is an excess of supply, in part due to deliberate actions taken early on by CARB to keep permit prices from rising too high (with permits for as much as 90 percent of corporations' initial obligations actually being distributed for free). More importantly, since then, banking has served to perpetuate this oversupply of permits. Michael Wara, an environmental policy expert at Stanford, estimates the total number of banked permits that subject entities have available post-2020 at around 300 million,[145] which is more than the difference between California's 2020 target (431 million metric tons of CO_2-equivalent) and its 2030 target under SB 32 (258.6 million metric tons). Many analysts, including Wara and Chris Busch at Energy Innovation (who gives his own estimate of oversupply of permits at 270 million)[146], have called for the program's cap to be adjusted to account for the likelihood of these banked permits being

[145] Benjamin Storrow, "Price Hike Marks New Era for Calif. Cap-and-trade," *E&E News*, January 3, 2022, https://www.eenews.net/articles/price-hike-marks-new-era-for-calif-cap-and-trade/

[146] Chris Busch, "Oversupply Grows in the Western Climate Initiative Carbon Market," Energy Innovation, December 2017, p. 3, https://energyinnovation.org/wp-content/uploads/2018/03/WCI-oversupply-grows-Feb-28-update.pdf

carried over post-2020; otherwise, subject entities could just submit permits they already have banked to meet their obligations, and not need to buy new permits or take measures to reduce emissions from their operations.[147] The state Legislative Analyst's Office, for its part, outlined a scenario in a 2017 report where over 200 million banked permits are submitted for post-2020 obligations, which LAO claims could cause subject entities to overshoot an emissions level consistent with California's 2030 target by 30 percent.[148] On the other hand, Severin Borenstein, director of the Energy Institute at Haas at UC Berkeley, disputes the claim that banking is seriously undercutting the effectiveness of the cap-and-trade program, and presents analysis to suggest that adjusting the emissions cap to account for banked permits would in all probability not have much effect on actual emissions by 2030.[149]

In a 2016 paper, Cullenward and Coghlan likewise present low prices on the secondary market for cap-and-trade permits, which had been at or even below the price floor for auctioned permits at the two most recent auctions that year, as the Achilles' heel of California's program.[150] Cullenward and Coghlan highlight low prices as holding the program back from realizing emissions reductions on the scale that California's plans anticipate post-2020; they present three separate reasons for why permit prices have remained depressed, that are linked to demand rather than supply. In particular, California's climate strategy is often duplicative, with many corporate operations that are subject to cap-and-trade also being regulated by a command and control policy like RPS and LCFS. Furthermore, the cap-and-trade program allowed for

[147] Herman Trabish, "Is Cap-and-trade the Climate Solution? The Jury's Still Out," *Utility Dive*, January 19, 2018, https://www.utilitydive.com/news/is-cap-and-trade-the-climate-solution-the-jurys-still-out/514747/

[148] Mac Taylor, "Cap-and-trade Extension: Issues for Legislative Oversight," California Legislative Analyst's Office, December 2017, p. 8-9, https://lao.ca.gov/reports/2017/3719/cap-trade-extension-121217.pdf

[149] Severin Borenstein, "California's Carbon Cap is not in Jeopardy, Because it's not Really a Cap," Blog, Energy Institute at Haas, January 2, 2018, https://energyathaas.wordpress.com/2018/01/02/californias-carbon-cap-is-not-in-jeopardy-because-its-not-really-a-cap/

[150] Danny Cullenward and Andy Coghlan; Structural Oversupply and Credibility in California's Carbon Market. *Electricity Journal* 2016; 29(5): 7–14

"resource shuffling" in the early stages of its enactment, where, in around 2012-2014, utilities divested themselves of their most heavily polluting out-of-state facilities, and thus reported a decline in emissions from their operations even though those facilities' new owners continued to release the same level of emissions outside California's borders. (Cullenward and Coghlan's third reason is uncertainty about the future of cap-and-trade and the continued fungibility of permits, but that seems less relevant now, with the program having been successfully extended to at least 2030 since their paper was published.)

The second of these sources of low demand is perhaps the most troubling; it indicates a broader problem known as leakage, where a tough pollution control policy in one jurisdiction leads to reductions that really only exist on paper, because the polluting activities simply moved to neighboring jurisdictions with less stringent rules. Understandably, as a subnational entity that is closely integrated with the economies of neighboring states, California would be especially vulnerable to GHG emissions leakage. Cullenward has highlighted the threat of leakage as far back as 2014, when he first called attention to resource shuffling by utilities. As an illustrative example, in 2013 Southern California Edison sold its coal-fired Four Corners Power Plant in New Mexico, which provided power to its California customers, to a utility serving Arizona.[151] At the time, Cullenward estimated that the sale caused a leakage of between 19.4 and 34.8 million tons of CO_2 out of California.[152] In their 2016 paper, Cullenward and Coghlan put the potential maximum leakage out of state since the beginning of the cap-and-trade program at 120-360 million metric tons of CO_2-equivalent, with much of that amount coming from divestment from coal-fired plants alone. For context, a typical quarterly cap-and-trade action sells permits equal to about 80 million metric tons of CO_2-equivalent.

[151] Danny Cullenward; How California's Carbon Market Actually Works. *Bulletin of the Atomic Scientists* 2014; 70(5): 35–44; p. 35
[152] Danny Cullenward; Leakage in California's Carbon Market. *Electricity Journal* 2014; 27(9): 36–48; p. 11

As Cullenward acknowledges, the text of AB 32 directs CARB to draft rules to minimize leakage and ensure that only net reductions of GHG emissions in the atmosphere are counted, and indeed CARB has instituted standards under the cap-and-trade program that aim to combat resource shuffling. However, Cullenward claims that the thirteen "safe harbor" exemptions to the resource shuffling ban, which CARB created following complaints from utility companies, are far too broad.[153] Cullenward does not give a more specific estimate of just how effective the resource shuffling regulations are, but a 2015 paper by Caron et al does endeavor to quantify future leakage from the cap-and-trade program. Caron et al conclude that, given the status quo of coverage of imported electricity under cap-and-trade and the program's regulations to prevent resource shuffling, leakage will be nine percent of recorded in-state GHG emissions reductions. Perhaps one cannot say whether that percentage is too high to accept (although it certainly could stand to be made smaller), but it is notable that Caron et al also find that, without those two features of the cap-and-trade program, leakage would be as high as 45 percent.[154]

While one might conclude that a solution to low permit prices could be to target oversupply by eliminating the option to bank permits for later use, and force corporations to expend or sell all their permits within a given compliance period, such an action would have its own harmful implications. In a 2017 paper that provides case studies of California's cap-and-trade program and similar initiatives around the world, Schmalensee and Stavins repeatedly note that banking has actually proven itself to be one of the key factors in the success of cap-and-trade programs, because (in tandem with the permit price ceiling that California and many other jurisdictions have) it provides a hedge against future price volatility and allows corporations to

[153] Cullenward 2014 (*Bulletin of the Atomic Scientists*), p. 38-40
[154] Justin Caron, Sebastian Rausch, and Niven Winchester; Leakage from Sub-National Climate Policy: The Case of California's Cap-and-trade Program. *The Energy Journal* 2015; 36(2): 167–190; p. 167

plan ahead more effectively.[155] Instead, it would seem that mitigating oversupply would require a commitment on behalf of regulators to reduce the number of permits released in future auctions at a faster rate, and furthermore, on the demand side, to address the problems of duplicative policies and leakage. Schmalensee and Stavins in particular identify California's duplicative command and control policies as undermining the effectiveness of cap-and-trade by reducing demand for permits.[156]

For all this discussion of design flaws in the cap-and-trade program that may be undermining its effectiveness, it is also possible that the cause of low carbon prices is exogenous trends. An alternate explanation for the low price of permits in the first few years of the cap-and-trade program is given by Lara Cushing, environmental health professor at UCLA, in an interview with the magazine *Grist*: "We had a huge recession in 2008 so emissions [in around 2013-2015] were down relative to where people thought they would be in 2013 – so the cap greatly exceeded the amount of pollution that was being emitted because the economy was still recovering."[157] Cushing's hypothesis is very attractive in its simplicity – it simply points out that California's target for 2020 was set in 2006, when California GHG emissions were near their record high, but due to the Great Recession two years later and the subsequent long recovery, that target proved easier to meet than anyone had previously anticipated. A 2017 analysis by Energy Innovation supports this explanation, highlighting both sluggish economic growth and rapid innovation in clean energy technologies: "Emissions falling faster than expected and resultant demand shortfalls reflect the success of California's overall policy efforts. Beyond successful climate policy, several economic and technological trends have caused California to

[155] Richard Schmalensee and Robert Stavins; Lessons Learned from Three Decades of Experience with Cap-and-trade. *Review of Environmental Economics and Policy* 2017; 11(1): 59–79
[156] Schmalensee and Stavins 2017, p. 68
[157] Nathanael Johnson, "The Biggest Fight over Cap-and-trade Isn't About What You Think it is," *Grist*, October 19, 2020, https://grist.org/climate/the-biggest-fight-over-cap-and-trade-isnt-about-what-you-think-it-is/

decarbonize more quickly and cheaply than regulators had expected when they were first designing the cap-and-trade program."[158]

The second critical economic parameter is efficiency, which asks whether the program is performing well if one takes cost into account. Of course, the cost of a government initiative is always a nebulous concept that can be conceived on in multiple different ways. For the purposes of this thesis, the cost to the government of administering the program (and, for that matter, the opportunity cost that the state government incurs by pursuing cap-and-trade as opposed to other options) are not of particular interest. Administrative costs are usually not what critics of the program are referring to when they say it is too expensive; within the broader debate about market-based mechanisms, the real concern is costs for subject entities. Chapter Two describes the many compromises that had to be made to overcome business opposition to AB 32 and the subsequent development of cap-and-trade. Even so, apart from claims that cap-and-trade is ineffective, the main argument against emissions pricing remains that it imposes too high a cost for businesses, and that these costs invariably are passed on to the economy as a whole.[159] This is a difficult argument to engage with since, as previously described, the purpose of cap-and-trade in many ways is, in fact, to raise costs for polluters, in order to make the price of their activities reflect the social costs. However, a negative spillover to consumers, and by extension any detrimental effects to the state economy, clearly cannot be ignored, especially given California's famously high gas prices and high cost of living in general.

A useful place to start, when evaluating the cost of the cap-and-trade program, is with its macroeconomic impacts on California. The first statistic to note must be that California's real

[158] Chris Busch, "Recalibrating California's Cap-and-trade Program to Account for Oversupply," Energy Innovation, March 2017, p. iv
[159] Anne Mulkern, "Gas Stations to Slap Cap-and-trade 'Cost' Labels on Pumps," *E&E News*, July 1, 2016, https://www.eenews.net/articles/gas-stations-to-slap-cap-and-trade-cost-labels-on-pumps/

GDP increased by about 25 percent from 2013 to 2019, while the real GDP of the United States increased about 15 percent over that time, calculating from Bureau of Economic Analysis data. This data does not allow for speculation about the precise role that the cap-and-trade program played in this rise (one might argue growth would be higher without cap-and-trade), but one can see that claims that cap-and-trade would prevent the state's economy from growing turned out to be unfounded. The cap-and-trade program only became more stringent, and expanded to cover a greater share of California's economic activity, over this time interval; and yet the state grew its economy faster than the country as a whole. Real GDP per capita for California increased by about 21 percent in 2013-2019, but only by about 11 percent nationally, as calculated from BEA data. Data from CARB further illuminates how California has decoupled its economy from GHGs, and thus mitigated a potential threat that cap-and-trade posed to economic growth; even as the state's economy has grown, the GHG emissions per unit of GDP (the carbon intensity of the state economy) has declined.[160] A 2021 paper adds further weight to the conclusion that the costs the California cap-and-trade program imposed on large polluting corporations have not reverberated throughout the economy to the extent that they pose a significant macroeconomic risk, by analyzing how banks responded to the enactment of the cap-and-trade program.[161] Ivanov et al find that large corporations that stood to be affected by cap-and-trade faced restricted access to credit during the transition period early in the implementation of cap-and-trade, but that the broader financial industry was able to adjust to the changed conditions relatively seamlessly. As Ivanov et al write, "these findings suggest that…legislation intended to

[160] CARB, "California Greenhouse Gas Emissions for 2000 to 2019," p. 5

[161] Ivan Ivanov, Mathias Kruttli, and Sumudu Watugala; Banking on Carbon: Corporate Lending and Cap-and-trade Policy. 2021. Available at SSRN: http://dx.doi.org/10.2139/ssrn.3650447

curb GHG emissions and transition to a low-carbon economy is unlikely to pose large, unmanageable risks."[162]

Analysis by the nonpartisan state Legislative Analyst's Office provide opportunities for direct comparisons of cap-and-trade to its command and control alternatives. According to a pair of 2020 reports from LAO, reducing one ton of GHG emissions through the cap-and-trade program would have a marginal cost of around $10-$17, over the period since 2013. Cap-and-trade's two most notable counterparts, RPS and LCFS, cost much more, with a marginal cost of $60-$70 per ton of GHG emissions reductions for RPS, and over $200 per ton of GHG emissions reductions for LCFS.[163] Of course, $17 may not be insignificant, but even if that entire amount is passed on by corporations to consumers, it still means the market-based approach is much more efficient than command and control, with cap-and-trade costing three times less to implement than the nearest alternative policy. One can argue whether $17 per ton is worth paying, but that seems fundamentally more of a political question than an economic one.

Finally, it is worthwhile to try to quantify the effect of cap-and-trade in one specific area, which is perhaps the most frequently cited example of its alleged harmful costs to California's economy – its impact on the price of gas. A 2021 analysis broke down the average cost of gas in California, and found that cap-and-trade adds just over 14 cents per gallon, a smaller effect than several other policies: around 22 cents per gallon for LCFS (at then-current credit prices), around 18 cents per gallon in federal tax, and over 50 cents per gallon in state tax (since it was raised in

[162] Ivanov et al 2021, p. 35

[163] Gabriel Petek, "Assessing California's Climate Policies – Electricity Generation," California Legislative Analyst's Office, January 2020, p. 21, https://lao.ca.gov/reports/2020/4131/climate-policies-electricity-010320.pdf *and* California Legislative Analyst's Office, "Assessing California's Climate Policies – Transportation," March 2020, p. 5-7, https://lao.ca.gov/handouts/resources/2020/Assessing-California's-Climate-Policies-03042020.pdf

2017).[164] Earlier, a 2016 paper found that, under an assumption of the cost of cap-and-trade being fully passed on to consumers, with cap-and-trade permit prices remaining within a fairly narrow window, the program would add around 9 cents per gallon to the cost of blended gas.[165] The effect of LCFS was essentially the same, assuming a LCFS credit price of $100 (which was roughly the price around 2016, although since then maximum credit prices have exceeded $200).[166] The paper notes that, in the first and second compliance periods, despite being legally subject to the program, refineries received permits to meet 100 percent of their expected emissions for free, thus minimizing the effect of cap-and-trade on gas prices.[167] It also points out that cap-and-trade and LCFS both work against and reinforce each other: LCFS (and other command and control policies, like RPS) lower cap-and-trade permit prices by mandating a phaseout of GHG emissions from various activities, thus dampening the incentive to exceed obligations under the program. On the other hand, cap-and-trade creates financial motivation for businesses to transition away from GHG emissions and compensates for compliance costs under the less efficient regulatory policies.[168] Overall, the conclusion seems to be that the precise effect of cap-and-trade on the price of gas is ambiguous: while the program stands to be made more stringent in the next decade, the specific impact on gas prices is likely to be counteracted by the exemptions that will probably be in place for refineries until at least 2030. On the other hand, state and federal taxes both add more to the price of gas; and it also appears clear that LCFS, representing the command and control approach to GHG emissions, will likewise have a greater effect, especially with LCFS credit prices having risen dramatically in the last few years.

---

[164] Leigh Noda, "Sacramento Policymakers Drive California's High Gasoline Prices," Stillwater Associates, February 1, 2021, https://stillwaterassociates.com/sacramento-policymakers-drive-californias-high-gasoline-prices/
[165] Sonia Yeh, Julie Witcover, Gabriel Lade, and Daniel Sperling; A Review of Low Carbon Fuel Policies: Principles, Program Status, and Future Directions. *Energy Policy* 2016; 97: 220–234; p. 228
[166] Yeh et al 2016, p. 228
[167] Yeh et al 2016, p. 228
[168] Yeh et al 2016, p. 229

Having concluded the discussion of the overall cost of cap-and-trade, this chapter can turn to the final economic parameter: how the cost that companies incur from complying with cap-and-trade is felt by low-income Californians. Here, an aspect of the California cap-and-trade program that has previously been little explored in this thesis becomes important – the redistributive effects from the disbursement of revenues from cap-and-trade auctions. California uses the distribution of revenues from cap-and-trade both to mitigate upfront costs for citizens, and to invest in further efforts to fight global warming. Cap-and-trade revenues are funneled into one of two programs: the California Climate Credit, which is received directly by households in the form of discounts on electricity and natural gas bills for customers of investor-owned utilities, and various climate investments funded through the Greenhouse Gas Reduction Fund. The credits are available for both electricity and natural gas consumption by residential properties and for electricity consumption by small businesses, and are distributed twice a year for electricity and once a year for natural gas. For Southern California Edison customers, the credits for 2022 will consist of double payments of $59 in April and October; SoCalGas customers are set to receive around $44 in April.[169] Money from the Greenhouse Gas Reduction Fund has been used to fund various programs that help low-income households by reducing energy demand or vehicle miles traveled, thus shielding people from a rise in the price of fossil fuels due to the compliance costs of cap-and-trade. Just two examples of these are the Low Carbon Transit Operations Program, which has awarded $636.4 million to transit agencies to expand public transportation options to underserved communities, and the Affordable Housing and Sustainable Communities Program, which has given out $1,228.1 million in loans and grants

[169] CPUC, "California Climate Credit," https://www.cpuc.ca.gov/industries-and-topics/natural-gas/greenhouse-gas-cap-and-trade-program/california-climate-credit

to support affordable housing construction.[170] Overall so far, $10.5 billion in cumulative funding from GGRF has gone to 8,939 affordable housing units that are completed or under contract, over 800 transit agency projects to add or expand service, and over 400,000 rebates for all-electric or hybrid vehicles.[171] According to the latest report, these investments have brought about reductions of 76 million metric tons of CO_2-equivalent and 70,000 tons of criteria air pollutants.[172] 50 percent of GGRF funding has gone to disadvantaged or low-income communities, exceeding the 35 percent minimum set by state law[173] (for the two specific programs mentioned above, that figure is over 80 percent).[174] Finally, California also offers assistance that is targeted to low-income energy and natural gas ratepayers, through programs like California Alternate Rates for Energy and Family Electric Rate Assistance; while not funded through cap-and-trade, these can further balance out its costs.

A 2016 study seeks to quantify how corporations passing on their cap-and-trade compliance costs, along with these cost-offsetting measures from the state, affect low-income residents of California, forecasting for the years from 2016 to 2020.[175] The study's authors designed eight hypothetical examples of low-income households that are representative of different potential consumption profiles for housing and transportation in California, and that represent several disadvantaged communities throughout California that display a wide range of background factors that affect households' energy and transportation expenditures. (These

[170] California Climate Investments, "Annual Report to the Legislature," p. A-5, p. A-7
[171] California Climate Investments, "Annual Report to the Legislature," p. i
[172] California Climate Investments, "Annual Report to the Legislature," p. i
[173] California Climate Investments, "Annual Report to the Legislature," p. i
[174] California Climate Investments, "Annual Report to the Legislature," p. A-5, p. A-7
[175] Julien Gattaciecca, Colleen Callahan, and J.R. DeShazo, Protecting the Most Vulnerable: A Financial Analysis of Cap-and-trade's Impact on Households in Disadvantaged Communities Across California, Luskin Center for Innovation, UCLA Luskin School of Public Affairs, April 2016

background factors included "climate zones, utility providers, [and] land use and transportation patterns.")[176] Their main finding, perhaps surprisingly, is that "the state is effectively protecting low-income Californians from cap-and-trade compliance costs passed through from electric, natural gas, and gasoline providers."[177] Because of various programs from the state, low-income Californians actually see a net benefit to their expenditures on electricity, natural gas, and gasoline under cap-and-trade.

The study estimates that low-income households could see a cumulative net benefit of $215-$246 on their electricity bills from 2016 to 2020,[178] and a cumulative net benefit of $44-$83 on their natural gas bills over that period.[179] In both cases, these savings are from low-income households receiving California Climate Credits that exceed the impact from the compliance costs of cap-and-trade. There are no similar credits available to offset the effect of cap-and-trade on gas prices, but the study also finds that low-income Californians could indirectly see net savings on their gas expenditures of $350-$700, cumulatively over 2015-2020, due to investments from GGRF and state rules that promote vehicle efficiency and various other initiatives to reduce gas consumption.[180] Admittedly, one weakness of the study is its case study methodology, but its findings do indicate that cap-and-trade does not impose a disproportionate burden on Californians; moreover, it illuminates how the cap-and-trade program funds critical efforts like California Climate Credits and GGRF, that are making a real difference in helping people save money.

While data making a direct comparison between cap-and-trade and California's command and control policies as pertains to the specific impact on low-income households could not be

[176] Gattaciecca et al 2016, p. 3
[177] Gattaciecca et al 2016, p. 29
[178] Gattaciecca et al 2016, p. 20
[179] Gattaciecca et al 2016, p. 23
[180] Gattaciecca et al 2016, p. 27

found, it must be noted that command and control policies, on their own, have no way to offer a similar revenue stream. Some of California's regulatory mechanisms, such as RPS, pose the same potential pitfalls as cap-and-trade – there is a concern that corporations will pass on their compliance costs to consumers, and that these costs will be disproportionately felt by low-income households. The added costs from command and control policies could very well be compensated for by other policies like low-income ratepayer assistance programs or energy efficiency rules. Similarly, while car manufacturers may pass on the costs of expanding their production of low-emissions vehicles to meet California's tailpipe emissions standards, these additional costs to consumers can be balanced out in the long-term due to savings on gas due to improved vehicle efficiency (since the most common way that manufacturers reduce their vehicle fleet emissions is by improving mileage per gallon). However, cap-and-trade is California's only climate policy that offers a "built-in" revenue-raising mechanism to ensure that its costs to low-income households are neutralized via progressive redistribution. California's experience thus demonstrates that an essential component of the economic impact of any emissions pricing mechanism is the investments that are enabled by the revenue raised; these investments are as vital to its viability as an emissions reduction strategy as the price signal itself.

In Chapter Three, I explore the economic impacts of California's cap-and-trade program: its effectiveness at reducing emissions, its overall costs to the state economy, and its specific effect on low-income households. Chapter Four discusses the other key aspect shaping the program's future viability: its political durability.

Chapter Four

There are myriad factors that affect the ability of cap-and-trade to win and retain the support of different political interests. In this chapter, I discuss how different elements of the California program's design have shaped its political support, expanding on the history of the enactment of cap-and-trade in California that I described in Chapter Two. I focus on the policy design elements that have influenced support for cap-and-trade among two diametrically opposed groupings, both of whom may comprise a numerical minority, but nevertheless exemplify the role of the political actor in that they punch above their weight in terms of their influence on California politicians. These two groupings are California's fossil fuel industry on the one hand, and grassroots community activism on the other. Through this analysis, I endeavor to illuminate in this chapter how the political success of the program interacts with its economic success, and how those two goals can be in opposition to each other.

The main reason why emissions pricing is promoted as a preferable course of action, politically speaking, compared to command and control regulation is its supposed amenability to business, as a strategy that makes use of market forces and thus allows for the economic costs to be minimized. Cap-and-trade specifically is thought to be more advantageous in regard to compensating for cost, when compared to the other method of pricing externalities via a per unit emissions tax, because cap-and-trade actually gives corporations the opportunity to earn a profit from selling unused permits. Not to mention, a market-based mechanism has great potential to encourage investment in a green transition, especially through revenue disbursement, that countless enterprises can benefit from. And, as described in Chapter Three, this is more than mere branding: there is real evidence that California's cap-and-trade program has been more economically efficient than command and control alternatives.

The need to contend with corporate opposition is something that policymakers around the world have to take into account when it comes to climate policy, but there is a California-specific context that has made the need to anticipate arguments about costs to business especially potent. This context is the reality that California, despite its environmentally friendly reputation, is also a major oil-producing state, and that the fossil fuel industry has long held far-reaching influence over state politics. After all, the oil industry drove much of the population growth in the Los Angeles area in the early 20th century; and fossil fuel interests continue to hold sway over many California politicians via the lobbying of industry trade groups, the most visible one being the Western States Petroleum Association.

The cost-effectiveness of cap-and-trade is, in turn, supposed to neutralize corporate lobbying against climate policies and allow conservative politicians to vote for emissions pricing policies, in the hope that the market-based approach will appeal to them philosophically and be more easily explained to their base. One might also assume that cap-and-trade would be easier for politicians to endorse than a carbon tax, since it avoids the appearance that they are voting for new taxes, although the intended effect is admittedly the same under both cap-and-trade and a carbon tax. Ultimately, the hope is that both corporate interests and the politicians they back will see that a market-based mechanism like cap-and-trade can be beneficial to them.

It is difficult to evaluate to what extent California's cap-and-trade program has exemplified this aspect of political viability. Undoubtedly, as described in Chapter Two, California policymakers made efforts to anticipate corporate opposition that were reflected in the design of the cap-and-trade program after the passage of AB 32. Even more of these efforts were taken by legislators in AB 398, the bill that extended the authorization of cap-and-trade to 2030; a price ceiling was applied to cap-and-trade permits, local regulatory enforcement of individual

facilities' GHG emissions was preempted, and refinery emissions were left mostly exempt. The most obvious way to judge whether these decisions paid off politically is to ask whether they won the votes of conservative-minded legislators – the fact that cap-and-trade was renewed in a second bill is useful towards this end, since one can make a direct comparison with AB 32. After all, the ostensible ability to win bipartisan support is the very reason that market-based mechanisms are considered the politically preferred option in the first place. In this regard, however, the results can only be described as lackluster at best– while much has been made of the fact that eight Republicans voted for AB 398 while only one voted for AB 32, this doesn't seem especially conclusive in the grand scheme of things. The vast majority of Republican legislators opposed the renewal of cap-and-trade, and likewise today one would be hard-pressed to find any elected Republicans in California who speak well of the program. Those eight Republican votes may have been a principled show of independence from their party, but they seem to have done little to motivate other Republicans to follow their example.

Of the seven Republican Assemblymembers and one Republican state Senator who voted yes on AB 398, four of the Assemblymembers still hold seats in that chamber as of spring 2022, including then-Minority Leader Chad Mayes. (The others are Devon Mathis, Heath Flora, and Jordan Cunningham.)[181] When AB 398 was signed into law, Mayes proudly told the Los Angeles Times that "California Republicans are different than national Republicans" due to their belief in and commitment to addressing global warming.[182] Of course, this statement glosses over the fact that, in the end, most California Republicans weren't that different from their national counterparts after all, since Mayes' efforts to whip his party caucus in support of the bill proved

[181] California Legislature, Assembly Bill 398, Legislative Session 2017-18, Bill Votes, https://leginfo.legislature.ca.gov/faces/billVotesClient.xhtml?bill_id=201720180AB398

[182] Melanie Mason and Chris Megerian, "California Legislature Extends State's Cap-and-trade Program in Rare Bipartisan Effort to Address Climate Change," *The Los Angeles Times*, July 17, 2017, https://www.latimes.com/politics/la-pol-ca-california-climate-change-vote-republicans-20170717-story.html

largely unsuccessful. For an additional layer of irony, within a month of AB 398 being signed into law, Mayes would be removed as Minority Leader by his party caucus over his support for cap-and-trade,[183] and he would later leave the Republican Party and now holds his seat as an independent. Out of the other four Republicans in favor of cap-and-trade, the three Assembly Republicans (Catharine Baker, Rocky Chavez, and Marc Steinorth) would all be replaced by Democrats in the 2018 midterm elections, following fierce condemnation of their votes by all the traditional conservative heavyweights, from the Howard Jarvis Taxpayers Association to the Wall Street Journal editorial page.[184] Chavez and Steinorth both declined to run for reelection that year, at least in part due to the strong hostility they continued to face within their party.

All this suggests that those eight votes ended up having little staying power. There are other prominent Republican voices who came out in support of renewal of cap-and-trade in California, most notably two former governors, Arnold Schwarzenegger and Pete Wilson, and former Secretary of State George Shultz.[185] Schwarzenegger in particular, who had signed AB 32 into law when he was governor, attended the signing of AB 398, and declared that the bipartisan vote demonstrates that "we can fight for free market policies to clean up our environment for our children at the same time we fight for a booming economy."[186] Nevertheless, elected Republicans in California in 2022 have, if anything, become even less likely to support not only cap-and-trade, but any action on global warming at all. As veteran California Republican political consultant Mike Madrid bluntly (and presciently) remarked about the passage of AB

[183] Jeff Horseman, "Republicans Oust Inland Assemblyman Chad Mayes as GOP Leader," *The Press-Enterprise*, August 24, 2017, https://www.pe.com/2017/08/24/chad-mayes-is-out-as-assembly-republican-leader/
[184] Melanie Mason, "Eight Republicans Backed Jerry Brown's Climate Bill–Here's What That Means for Their Political Futures," *The Los Angeles Times*, July 19, 2017, https://www.latimes.com/politics/la-pol-sac-cap-trade-climate-change-california-legislature-political-landscape-20170719-htmlstory.html
[185] Mason and Megerian, "California Legislature Extends State's Cap-and-trade Program"
[186] Mason and Megerian, "California Legislature Extends State's Cap-and-trade Program"

398 back in 2017: "Is this California leading the way with a new Republican philosophy? No."[187] The final conclusion from the aftermath of AB 398 may be that, even though the bill added several key concessions to a cap-and-trade program that was already designed to be something Republicans could support, cap-and-trade has failed to win buy-in from California's conservative politicians to a meaningful extent, and the Republican supporters it has attained seem like the exception that proves the rule. Nor has California's example helped promote cap-and-trade on the federal level; the fact that events in California have had no discernible effect on national Republicans' stonewalling of climate policy goes without saying.

While perhaps it is possible that concessions made to corporate interests appeased powerful actors like the Western States Petroleum Association, that would have used their influence to block cap-and-trade entirely if those concessions were not made (for example, by supporting Prop 23, or working to sabotage renewal in AB 398), there isn't an especially definitive method to quantify how much support the California cap-and-trade program has been able to gather from corporations. In a state where the oil and gas industries have so much political sway, corporate support can take the form not only of an affirmative statement, but also of a lack of action taken in opposition (as shown by the example of Prop 23 in Chapter Two). Ultimately, WSPA's insistence on preemption of regulatory enforcement implies that the fossil fuel industry considered cap-and-trade the lesser of two evils compared with command and control policies. Perhaps "begrudging tolerance of its existence" is the best way to describe how the fossil fuel industry in California feels about cap-and-trade. If in the future policymakers show themselves to be serious about strengthening the program so that it more effectively forces

[187] Mason and Megerian, "California Legislature Extends State's Cap-and-trade Program"

corporations to change their behavior, it appears quite feasible that corporate interests will actively start trying to dismantle the program again.

All in all, California's experience with cap-and-trade does not offer much evidence to vindicate the optimistic claim that a market-based mechanism can win durable affirmative support from large corporations, or from fossil fuel companies in particular. Moreover, one must recognize that support from corporations isn't important or even desirable in itself, politically speaking. The only reason to pursue it is because corporate influence ostensibly has the potential to bring conservatives around to supporting climate action, and thus enable passage of policies that otherwise would have failed. As argued above, there isn't much reason to believe this meaningfully happened in California's case, or could meaningfully happen in the foreseeable future.

On the other hand, relenting on issues like the continuation of free permits, the refinery exemption, and preemption have undoubtedly undermined grassroots support for the cap-and-trade program. In the end, the insistence on renewing cap-and-trade with a two-thirds majority may have been judged essential to ward off future legal challenges, but it came with the very real cost of weakening the program politically and economically. Maybe, if AB 398 had been enacted without the concessions to the fossil fuel industry but with a simple majority, the courts would have gone on to rule that the cap-and-trade program qualified as a tax and was unconstitutional (even though the suit arguing cap-and-trade was a tax had been unsuccessful thus far), in which case the compromises could be justifiable in the interest of securing the program's survival. But of course, there is no way to know for sure what would have happened in this alternate history. Although then-Governor Brown said when he signed AB 398 that "when you can lock something

in with support of Republicans and Democrats, it has durability,"[188] one is left with the conclusion that efforts to secure Republican support for cap-and-trade didn't actually make its continued survival any more likely, and any durability that the cap-and-trade program has really just comes down to the Democratic dominance of California politics.

The other influential grouping introduced at the beginning of this chapter – California's grassroots activists and organizations, whose chief concern is environmental justice for the low-income communities of color that their work centers on – are likewise generally not inclined to support cap-and-trade. The environmental justice movement is a distinct current of environmentalism, going back to academic research in the 1980s that illuminated the severe racial and income disparities throughout the United States in terms of which communities are most heavily affected by pollution and all its attendant health effects; the movement seeks to ensure the experiences and demands of the most disadvantaged areas are given priority in environmental policymaking.[189] In this sense, environmental justice groups' misgivings about cap-and-trade could be considered a conflict between their localized focus and the global outlook that the climate crisis demands.

Like the fossil fuel lobby, grassroots organizations are important due to the outsize influence they wield in California politics, thanks to the dedicated work of several highly vocal and well-organized groups like California Environmental Justice Alliance, Communities for a Better Environment, Coalition for Clean Air, Food and Water Action, and Los Angeles-based Stand Together Against Neighborhood Drilling (STAND-LA). Organizations like these are well-positioned to both rally popular support for climate action, and to leverage other key sources of influence like researchers, medical experts, and faith leaders – the California chapters of the

[188] Mason, "Eight Republicans Backed Jerry Brown's Climate Bill"
[189] EPA, "Environmental Justice Timeline," https://www.epa.gov/environmentaljustice/environmental-justice-timeline

American Lung Association and Interfaith Power and Light, just to give two examples, have both been heavily involved in pushing forward climate action at the state level in the last two decades.

Unfortunately for the political prospects of cap-and-trade, many in the environmental justice community regard emissions pricing as inherently inadequate to address global warming, and in particular as failing to address the disproportionate effect of GHG co-pollutants (the emissions regulated as criteria pollutants at the federal level) in low-income and majority-minority areas. This disparity is a direct result of fossil fuel infrastructure being more likely to be located in those areas. While the problem of unequal effects of fossil fuel pollution is observed nationwide, and is a concern for environmental policymakers around the world, it is perhaps especially urgent in California, due to the frequent occurrence of infrastructure like oil and gas wells or refineries located within densely populated neighborhoods.[190] Along the same vein, GHG offsetting is a particular target of activists' anger and distrust: due to the additionality problem, it is often claimed that offsets are fatally undermining the cap-and-trade program's effectiveness by allowing corporations to buy their way out of reducing emissions from their operations, and are perpetuating the myriad ways that fossil fuels harm the most vulnerable communities. Such a claim, it must be said, comes off as disingenuous, since those who make it practically never mention that California only allows corporations to meet a small percentage of their obligations by purchasing offsets, let alone that (as shown in Chapter Three using public data) the actual percentage of reported emissions reductions under the cap-and-trade program that was achieved through offsets has been below the limit for all three past compliance periods.

The concessions that California lawmakers made to big business in AB 398 only furthered the image of cap-and-trade as a corporate giveaway that allows polluters to avoid

[190] Zoe Woodcraft, "In the Shadow of Big Oil: Neighborhood Drilling in California," Earthjustice, June 11, 2021, https://earthjustice.org/features/buffer-zones-oil-drilling-california-neighborhoods

taking serious action to cut their emissions, and thus evade accountability for their role in both creating the climate crisis and perpetuating environmental injustices. Most notable are the large fraction of cap-and-trade permits that will continue to be distributed for free and thus depress permit prices, and the preemption of direct regulation of local pollution sources. Those concessions, of course, were heavily pushed for by the fossil fuel industry and other corporate interests, especially local preemption. That being said, the cap-and-trade program includes elements designed to appeal to the grassroots as well: GGRF investments are channeled into various programs that aim to channel the environmental benefits of cap-and-trade to the local community level, and California law sets a minimum percentage of cap-and-trade revenue that must be directed to low-income communities and communities disproportionately affected by fossil fuel pollution.

It is useful to evaluate the accusation that the cap-and-trade program has perpetuated environmental injustice at the local community level, in the form of an increase in (or at least a failure to reduce) GHG co-pollutants and the deadly air pollution they are responsible for. This question is explored here and not with the overall discussion of the cap-and-trade program's effectiveness in Chapter Three because, as crucial as environmental justice is for so many, the cap-and-trade program was ultimately enacted to target GHG emissions and not criteria air pollutants. Nevertheless, environmental justice concerns are clearly critical to the political prospects of cap-and-trade in California, so it cannot go unaddressed in this thesis. There has been one highly influential paper investigating the California cap-and-trade program's effects on co-pollutants, a 2018 study by Cushing et al that compares emissions data from before the implementation of cap-and-trade in 2011-2012, to after in 2013-2015 (the last years for which

data was then available).[191] Cushing et al's main finding is that "neighborhoods that experienced increases in annual average GHG and co-pollutant emissions from regulated [stationary] facilities nearby after [2013] had higher proportions of people of color and poor, less educated, and linguistically isolated residents, compared to neighborhoods that experienced decreases in GHGs."[192] However, Cushing et al are only able to report a correlation, not a causation; while it may be true that the cap-and-trade program has failed to improve localized air pollution, their findings do not show that cap-and-trade perpetuated or exacerbated that pollution.

CARB, in fact, makes the same point in a rebuttal to this very paper, on an FAQ page for the cap-and-trade program on the agency website: "increases in greenhouse gas (GHG) emissions were observed (as a result of the economy coming back after the 2008 recession and other factors), but the lead study author notes that the study does not actually show the implementation of the cap-and-trade program made local air quality worse. … [T]here was no cause and effect demonstrated."[193] The fact that the FAQ page begins with three questions specifically about the alleged link between cap-and-trade and local air pollution disparities is perhaps an indication of just how politically potent this concern is. Also, another 2018 paper examining the question of the California cap-and-trade program and environmental justice, by Anderson et al, presents much the same conclusion, finding that "the cap-and-trade program has limited impacts, including limited disproportionate impacts, on air quality in disadvantaged communities."[194] That being said, recalling Cushing et al's conclusions, Anderson et al note that

[191] Lara Cushing, Dan Blaustein-Rejto, Madeline Wander, Manuel Pastor, James Sadd, Allen Zhu, and Rachel Morello-Frosch; Carbon Trading, Co-pollutants, and Environmental Equity: Evidence from California's Cap-and-trade Program (2011-2015). *PLOS Medicine* 2018; 15(7): e1002604
[192] Cushing et al 2018, p. 2
[193] CARB, "FAQ"
[194]Christa Anderson, Kendall Kissel, Christopher Field, and Katharine Mach; Climate Change Mitigation, Air Pollution, and Environmental Justice in California. *Environmental Science and Technology* 2018; 52: 10829–10838; p. 10829

many stationary sources of pollution in disadvantaged communities are exempt from cap-and-trade or only lightly subjected to it, and also that a reduction of GHG emissions does not necessarily yield the same amount of reductions of co-pollutants.[195]

Nonetheless, grassroots activists tend to favor a command and control approach, as regulations can directly mandate emissions reductions at the level of individual sources. Thus, politically speaking, California's cap-and-trade program can be said to be in the worst of both worlds: efforts to win durable support from the fossil fuel industry and Republicans have yielded very little success, while grassroots activists (even if they do not actively seek to dismantle the program) are disenchanted with it and are not motivated to fight for it to be strengthened. This is especially unfortunate since, as described in Chapter Three, evidence suggests that cap-and-trade is actually in the best of both worlds economically; the program has for the most part worked so far, and while it does need to be made tougher if it is to play the leading role that the state projects it to play in meeting California's targets for 2030 and beyond, there is no fundamental reason why those changes cannot be made. Those changes would serve to address many of the very same weaknesses that make cap-and-trade unpopular in environmental justice activist circles. However, because much of the grassroots community seems convinced not only that the cap-and-trade program isn't working but that it can never work, there simply isn't enough of an interest in organizing to achieve those changes. Out of all the campaigns that have animated California environmental justice groups in the last few years, reforming the cap-and-trade program seems noticeably absent, even as CARB prepares to release its 2022 Scoping Plan for the crucial next phase of the program after 2020.

[195] Anderson et al 2018, p. 10829

Bang et al present a very interesting conclusion on the interaction between the cap-and-trade program and command and control policies: based on several interviews, they claim that policymakers intended for the so-called complementary policies (RPS, LCFS, energy efficiency) to actually be the principal drivers of California's GHG emissions declines, and for cap-and-trade to serve the apparently cosmetic role of inspiring the rest of the world and assuaging conservative and industry opposition. This was supposedly done purely for political reasons, even with the acknowledgement that command and control is more costly. Bang et al explain:

> "The policy mix was purposely designed this way to avoid soaring permit prices and political controversy, according to the regulators and legislators we interviewed. If [permit] prices had been too high – making the real costs of abatement transparent [apparently, as opposed to the less visible effects of command and control regulations] – protests could have mounted against cap-and-trade and potentially jeopardized its continuance. The climate policy package is built to gradually increase [permit] prices and gradually increase the acceptance of cap-and-trade among stakeholder groups."[196]

This conclusion comes from several anonymous interviews conducted in 2015 with people who were closely involved in the development of the cap-and-trade program: representatives of CARB and the California Energy Commission, a legislative assistant for a Democratic state senator, a legislative assistant for the State Senate Energy, Utilities, and Communications Committee, and a sitting Democratic state senator.[197] If true, this is ironic in light of the evidence presented in Chapter Three that the cap-and-trade program may actually have been more impactful than its progenitors meant for it to be. It also would contrast with the 2017 Scoping Plan's reliance on the cap-and-trade program to achieve the plurality of California's needed emissions reductions.

If the cap-and-trade program is to be made more popular, it seems the more promising avenue to achieve that is winning the support of grassroots environmental justice organizations,

[196] Bang et al 2017, p. 22
[197] Bang et al 2017, p. 30

and more broadly the people in the low-income communities they serve. The most impactful way to do this would be to strengthen the program's rules to ensure that it is up to the dual tasks of mitigating California's contribution to global warming and promoting environmental justice. How cap-and-trade in California can be strengthened and reinforced will be summarized in the conclusion to this thesis. At the same time, in terms of political branding alone, there is much that can be done to place renewed emphasis on cap-and-trade as a progressive policy with a redistributive potential to help disadvantaged communities. Kintzele's 2017 paper stresses the importance of how GGRF funding under the program is allocated and spent to cap-and-trade's overall political future: "simply put, putting a price on carbon emissions has never been more lucrative for the state of California."[198] As the California program's predecessors like RGGI had previously understood, a major way to center the benefits of cap-and-trade in the public consciousness is to ensure the utmost efficacy and transparency in which projects are awarded cap-and-trade funding. California leaders should take care to not repeat some of the questionable funding decisions made in past years, in particular Jerry Brown's move to allocate a substantial part of cap-and-trade revenues (as high as a third, at least in an initial proposal) to the state's moribund and long delayed high speed rail project, which was the subject of considerable vitriolic criticism from Republicans and the media.[199]

Raymond's 2019 paper similarly presents overall guidelines on how a cap-and-trade program can build political support, using the case studies of California's program, ETS in the EU, and RGGI. Raymond writes that policymakers must emphasize "using revenue to promote

[198] Jonathan Kintzele; Easy Come, Easy Go: A Guide to California Cap-and-trade Spending. *Southern California Law Review* 2017; 90(3): 719–753; p. 720

[199] Fox News, "California Eyes Plan to Speed Bullet Train Using Cap-and-trade Program Proceeds," December 20, 2015, https://www.foxnews.com/politics/california-eyes-plan-to-speed-bullet-train-using-cap-and-trade-program-proceeds

tangible, widely distributed, and easily recognized public benefits."[200] This should be done not simply for populist reasons, but in keeping with widely agreed upon societal standards of fairness, namely the polluter pays principle and the equitable distribution of public goods.[201] In particular, attention should be paid to the potential of cap-and-trade revenues to cushion ordinary citizens from increases in the price of fossil fuels, while otherwise preserving the integrity of the cap-and-trade program's price signal. Essentially, cap-and-trade programs must find the right balance between direct and immediately appreciable economic benefits to households (like through the California Climate Credit), and the broader goals of using revenues to pursue GHG emissions reductions and environmental justice. In a place like California where the issues of high cost of living and economic inequality are of paramount political concern, perhaps greater weight should be placed on the former. A further takeaway may be that, when revenues are employed to achieve somewhat more abstract societal objectives rather than funneled directly into people's pockets, it is most politically advisable if the funded projects unambiguously fall under the umbrella of climate- or environment-related efforts. Put another way, there are well-defined market failures that disbursement of cap-and-trade funds can correct, such as the lack of investment in zero-emissions technological innovations and inadequate building out of clean energy infrastructure, or the failure to grow affordable housing and mass transit.[202] Any person questioning what cap-and-trade can do for them is able to appreciate that most people would agree these societal goods are sorely needed, and since the free market is unable to provide them, it falls to the government to intervene.

---

[200] Leigh Raymond; Policy Perspective: Building Political Support for Carbon Pricing–Lessons from Cap-and-trade Policies. *Energy Policy* 2019; 134: 110986-1–110986-7; p. 5
[201] Raymond 2019, p. 3
[202] Jesse Jenkins; Political Economy Constraints on Carbon Pricing Policies: What are the Implications for Economic Efficiency, Environmental Efficacy, and Climate Policy Design? *Energy Policy* 2014; 69: 467–477; p. 475

This chapter concludes the discussion, begun in Chapter Three, of how California's cap-and-trade program has performed on economic and political metrics of success, in comparison to the alternative of command and control regulation. Both chapters suggest what the program's economic and political weak points are and how they might be rectified. In Chapter Five, I endeavor to give further insight to this analysis through an interview with Fran Pavley, the former California legislator who was responsible for drafting AB 32 and thus kickstarting the development of the cap-and-trade program.

Chapter Five

Fran Pavley has been called the "mother of California climate change policy"[203] due to her spearheading of three of California's most groundbreaking climate bills: AB 1493, AB 32, and SB 32. These bills were critical to building the national and international reputation of California as a leader on climate policy; the Obama Administration took direct inspiration from the so-called Pavley standards enacted under AB 1493, the first in the world to regulate GHG emissions from vehicle tailpipes, when it implemented its own standards at the federal level. Pavley, a former middle school teacher, was elected the first mayor of Agoura Hills when the city incorporated in 1982. She later went on to serve in the California State Assembly from 2000-2006, and then in the State Senate from 2008-2016. She is currently the Environmental Policy Director at the Schwarzenegger Institute at USC.

Interviewed on February 4, 2022, Pavley provides an inside look into the drafting of AB 32, which can further inform an analysis of the political viability of cap-and-trade. For one thing, Pavley recognized that her bill must leave it up to CARB to determine precisely how California would meet its enumerated emissions targets. CARB's long-standing reputation for expertise and

[203] Joe Mathews, "Passing the Torch of Climate Policy," *Ventura County Star*, August 29, 2016, https://www.vcstar.com/story/opinion/columnists/2016/08/29/joe-mathews-passing-torch-climate-policy/89562366/

impartiality was acknowledged across the political spectrum, and Pavley sought to avoid the impression that the highly technical rulemaking process was influenced by political concerns. As Pavley said, "we're a unique state. We have some of the best agencies on the planet." This was contrary to the preference of then-Governor Schwarzenegger, who wanted to specifically mandate the employment of a market-based mechanism in AB 32. It is clear that Schwarzenegger, for his part, fully believed in the promise of emissions pricing; Pavley recalls his refrain that "we have to prove AB 32 is good for the economy as well as the environment." However, partly in the interest of depoliticizing the implementation process, Pavley left the matter open in the bill's text, with the language only saying that a market-based mechanism like cap-and-trade was one possible strategy.

The other reason for this move, however, was that Pavley did not fully share the governor's confidence in cap-and-trade's effectiveness, having observed the overly permissive way that the European Union's program was implemented. Pavley explained:

> "I would not dictate a [cap-and-trade] program; we hadn't seen it be successful in Europe, they gave away too many [permits]. So the compromise language in AB 32, that I accepted, was that it gave [CARB] the authority to adopt a market-based mechanism, and they could have all the hearings with all the stakeholders – and it took several years to adopt it. Having legislators who don't really have that kind of expertise, and making it just a political decision, didn't make sense to me."

The leniency of the European program is perhaps important to keep in mind as Pavley goes on to describe corporate leaders taking great interest in her bill, and ultimately being very supportive of implementing its target through cap-and-trade. The national context was also significant, since the drafting of AB 32 coincided with discussions about emissions pricing at the federal level. These would coalesce into the Waxman-Markey bill, which would have created a national cap-and-trade program. While the Waxman-Markey bill would fail to pass the Senate in 2010, Pavley describes how in the preceding years national corporate leaders endeavored to exert their

influence over AB 32 (including by meeting with her personally), in the anticipation that California would once again serve as a trailblazer for the rest of the country on environmental policy. She acknowledges that business buy-in did "lower the temperature of opposition, other than perhaps from the fossil fuel industry;" because "they thought it was going to pass nationally, [and] they wanted us to adopt something that they could live with."

Pavley's telling leads to several conclusions regarding the feasibility of winning support from big business for cap-and-trade. First, even if support from business interests "lowered the temperature," it evidently was not enough to move the needle much in the way of securing bipartisan support, since in the end only one Republican legislator voted for AB 32. Moreover, Pavley suggests that corporations supported AB 32 because they were apprehensive that cap-and-trade would be enacted nationally and sought to influence the federal program's design to their advantage as much as they could by helping shape California's precedent. In today's political environment, with national emissions pricing much less likely to be even considered in Congress, that incentive to cooperate with California lawmakers on climate policy would be gone. All in all, Pavley's recollection reinforces the conclusion that corporations, and in particular the fossil fuel industry, will always be highly unlikely to affirmatively support cap-and-trade, regardless of any of its pro-market philosophical underpinnings.

Possibly the best that can be hoped for is that, in a place like California where emissions pricing has already been enacted, corporations will recognize it as the more preferable of two evils (compared to command and control) and will not actively work to end it. However, this does not fix the problem of the cap-and-trade program lacking political durability due to owing its survival to California's Democratic majority. Pavley does, however, note one group of business leaders that were especially excited about the possibility of cap-and-trade in California:

investors in the clean energy sector, since a cap-and-trade program promised to massively increase investment in zero-emissions technologies. This lends further credence to the key takeaway that the way to improve the political prospects of the cap-and-trade program is to reemphasize the wide-ranging investment in California and its future of innovation, that revenues from cap-and-trade stand to make possible. Pavley states later in the interview that the major way that the cap-and-trade program has helped disadvantaged communities is through revenue disbursement: "a growing percentage of it is spent in environmental justice communities – maybe it's access to transit or putting in electric vehicle charging infrastructure, the list goes on and on. Frankly, it's provided a way for legislators to show a benefit in their districts."

As for the other factor in the cap-and-trade program's political prospects – its appeal in activist circles – Pavley acknowledges that some of the alleged pro-corporate concessions are justifiable, such as granting free permits to businesses that cannot easily reduce emissions from their operations. As Pavley says, "the challenge was some of those stationary sources that really didn't have a way to cost-effectively reduce emissions or switch the kind of fuel they use, like the cement industry. So they end up giving free [permits] to the cement industry and others, because the thinking was, and it's the right one, if you're concerned about GHG emissions closing down the cement facilities in California just to have them go to Nevada does not make sense." Nevertheless, Pavley suggests that the fundamental political problem facing the cap-and-trade program, the reason it is seen as ineffectual at both achieving environmental justice and as an emissions reduction strategy in general, is that the program has expanded far beyond the role initially planned for it. According to Pavley (and supported by the 2008 Scoping Plan),[204] cap-and-trade was intended to realize only around 18 percent of the GHG emissions reductions

[204] CARB, "Climate Change Scoping Plan," December 2008, p.17, https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/document/adopted_scoping_plan.pdf

needed to achieve the 2020 target. By comparison, in the 2017 Scoping Plan, the projected role of the cap-and-trade program is more than twice that much: the state is relying on cap-and-trade for 38 percent of GHG emissions reductions ahead of the 2030 target. Cap-and-trade was envisioned as working alongside other policies, "additive to a regulatory approach;" consequently, in its current state, it cannot have the impact demanded of it.

Pavley considers cap-and-trade to have initially been conceived of as a "stopgap" measure to be put in place while the state ramped up its regulatory efforts (like energy efficiency or the soon-to-be-created LCFS); furthermore, she believes that strengthening the cap-and-trade program to play a greater role in reducing California's emissions comes with its own concerns. Specifically, while cap-and-trade may be less expensive to implement, she regards a market-based mechanism as inadequate to achieve AB 32's goal of improving environmental justice by mitigating criteria air pollution disparities at the local community level. As Pavley said, "you don't want to give everyone a chance to just buy their way out of it by purchasing forests." Ultimately, she feels both cap-and-trade and command and control measures will need to be expanded ahead of California's 2030 target: "I see [cap-and-trade] as a way to close the gap; it provided flexibility to some businesses that needed it as they transitioned [away from fossil fuels]. For us to get to [the 2030 target], expanding cap-and-trade isn't necessarily the only solution you should be looking at." For Pavley, a particular focus of future regulatory efforts should be diesel trucks and more broadly Southern California's logistics industry, which poses a disproportionate threat to the health of low-income communities of color. Towards this end, cap-and-trade does not offer a clear path to addressing pollution from trucks directly at the source, with the program's only avenue to impact vehicular emissions being through its requirement that distributors of transportation fuels buy emissions permits.

Overall, Pavley points to the upcoming 2022 Scoping Plan as the best indicator of how much CARB plans to rely on the cap-and-trade program going forward. She believes that the 2020 emissions target may, in a sense, have been low-hanging fruit, and that achieving the 2030 target will be much harder. It may very well require new programs or initiatives on top of what the state already has, to effectively mitigate emissions from sources like transportation, or from methane and other relatively short-lived pollutants with high global warming potential. Pavley emphasizes that global warming has proven to be a much more urgent and severe crisis than anyone anticipated, even back in 2006: "we haven't seen, in our state, anything like the intensity of year-round wildfire seasons." She concludes, "this is the puzzle for California – how do we reduce emissions, but also adapt [to the growing impacts of global warming], more quickly than we'd ever have thought. Most of these impacts are something we thought would happen maybe in 2050, not in 2022."

Chapter Six

This thesis has presented an analysis of California's cap-and-trade program on economic and political measures of success, with a wide range of conclusions. My research indicates that the program has been relatively successful in economic terms. The data suggests that the cap-and-trade program is having a real impact on California's GHG emissions, perhaps even a greater effect than the state's complementary command and control policies. At the very least, my research allows for the most pessimistic interpretations – such as the claim that cap-and-trade is meaningless because corporations are evading their obligations by purchasing offsets – to be disregarded. For all three compliance periods before 2020, corporations used offsets to meet a smaller percentage of their obligations than allowed by the cap-and-trade program. Not only did

California meet its 2020 target four years early, but emissions declined in California twice as much as in the United States as a whole over the same timeframe.

Scholarly analyses have identified policy design flaws that keep the effective price of carbon low, possibly too low to meet California's future climate goals – in particular, oversupply of permits on the supply side, and duplicative regulatory policies and leakage on the demand side. However, publicly available data does suggest that the cap-and-trade program has been effective at driving GHG emissions reductions up to now. Moreover, the cap-and-trade program is more efficient than its policy alternatives, achieving emissions reductions at a lower cost. Finally, due to the potential for progressive investment offered by cap-and-trade revenues, the cap-and-trade program is working at protecting low-income Californians from added costs. These revenues are a benefit unique to market-based mechanisms; a command and control approach does not come with similar revenue-raising potential.

Since California's 2030 goal calls for emissions declines at a faster rate than what was needed to meet the 2020 goal, it is undeniable that meeting the state's future targets will require California to do more than it is doing now. The question thus becomes whether this gap in climate policy will be filled by strengthening the cap-and-trade program or by enacting stricter command and control regulations. From a purely economic standpoint, the preponderance of evidence indicates that California would be better served by increasing the role of the cap-and-trade program. While regulations will most likely end up being expanded compared to now, with some additional command and control efforts being employed to fill the policy gap, in the interest of avoiding duplicative policies these new regulations should be tailored to activities that are not easily affected by the cap-and-trade program. California has indeed announced several major new regulatory initiatives in the last few years, and it is promising that they seem to be

focused on areas where the cap-and-trade program has not been as successful in reducing emissions at the source, in particular transportation. Just this month, CARB released a proposal to implement Governor Gavin Newsom's executive order to end sales of gas-powered vehicles by 2035;[205] in 2020, CARB finalized a regulation to mandate that all trucks sold in California be zero-emissions by 2045.[206] Another sorely needed target for regulations is short-term pollutants like methane, which are only a small percentage of a corporation's emissions but have a much higher global warming potential than CO_2. Under SB 1383 (2016), California mandated reductions of 40 percent from 2013 levels for methane and hydrofluorocarbons before 2030, and directed CARB to devise regulations to achieve those goals;[207] CARB has drafted new rules that have gradually gone into effect over the last few years.[208]

Furthermore, if the cap-and-trade is to be prioritized in meeting California's 2030 GHG emissions target, it will have to be made more stringent. Scholarly analyses cited in this thesis suggest ways this can be accomplished. To address oversupply, CARB will have to commit to releasing fewer permits, and decreasing the number of available permits at a faster rate, over the next decade. Whether or not the cap ends up decreasing to fully account for banked permits, the state cannot continue, for example, giving refineries 100 percent of their needed permits for free. A possible further action is to target banking directly by lowering the holding limit on permits; the formula sets the holding limit to decline as the statewide emissions cap declines, but changing the formula itself to be stricter may be warranted. Addressing low demand for permits

[205] Emma Newburger, "California Unveils Proposal to Ban New Gas-Fueled Cars by 2035," *CNBC*, April 13, 2022, https://www.cnbc.com/2022/04/13/california-releases-proposal-to-ban-new-gas-fueled-cars-by-2035-.html
[206] Sean O'Kane, "California Makes Zero-Emission Trucks and Vans Mandatory by 2045," *The Verge*, June 26, 2020, https://www.theverge.com/2020/6/26/21304367/california-electric-trucks-vans-clean-air-pollution-mandatory-rule
[207] California Legislature, Senate Bill 1383, Legislative Session 2015-16, https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383
[208] CARB, "Oil and Gas Methane Regulation," https://ww2.arb.ca.gov/resources/fact-sheets/oil-and-gas-methane-regulation

must also be an integral part of any strategy to reinforce the cap-and-trade program. One way this can be done is by working to avoid duplicative regulations in the future (as described above). A further crucial step could be to reevaluate the thirteen exemptions to CARB's ban on resource shuffling, to ensure the state is effectively mitigating emissions leakage.

The real problem, however, is political: California's cap-and-trade program may be doing relatively well economically (and outperforming command and control approaches), but its political success has not matched up to its economic success. Attempting to improve the support of cap-and-trade among the fossil fuel industry and the conservative politicians that support it is probably a fool's errand, and is inconsistent with the need to strengthen the program outlined above. However, the lack of enthusiasm for cap-and-trade among grassroots activists, and the perception of the program as perpetuating environmental injustice, absolutely must be addressed. If the program can be made more stringent so that it drives real and accelerated reductions of GHG emissions from refineries and other fossil fuel infrastructure in low-income communities, then one can anticipate it would have a meaningful (if not necessarily one-to-one) impact on emissions of criteria pollutants from these facilities as well. Moreover, environmental justice concerns may be the other key aspect of climate policy where a command and control approach is preferable, since regulations can target pollution at the level of individual sources. If California policymakers want to achieve buy-in from the grassroots activism community, they should eliminate the preemption of local regulation of GHG emissions (which the legislature can do with a simple majority vote)[209] that was enacted in AB 398. Going further, to take some of the political heat off the cap-and-trade program, California should recommit to using targeted regulations of oil and gas operations to improve environmental justice outcomes. An especially

[209] Eric Biber, "Thoughts on AB 398," *Legal Planet*, July 14, 2017, https://legal-planet.org/2017/07/14/thoughts-on-sb-398/

promising effort is the proposed statewide regulations to implement a minimum distance ("setback") of 3,200 feet between oil and gas operations and any homes, schools, or hospitals.[210] California is in fact unique among major oil-producing states in not having any setbacks; in the last few years, the failure of two legislative attempts to establish setbacks ultimately forced Governor Newsom to take action. Finally, another critical way to build support for cap-and-trade is, as argued previously, through the redistributive power of revenue disbursement; this can call attention to what cap-and-trade can do to meet each individual community's needs.

This thesis has focused almost entirely on an evaluation of California's cap-and-trade policy in comparison to potential alternative policies, in the context of California's emissions targets and its unique political and economic conditions. Since these conditions can vary so much across jurisdictions, a case study of one particular program, as I have done here, is perhaps the most informative and unambiguous method of analyzing the value of market-based mechanisms as a strategy to fight global warming. However, cross-jurisdictional comparisons of various market-based mechanisms have been done, and it is worthwhile to examine them to see how California measures up. One 2018 meta-study by Narassimhan et al evaluates research on the emissions trading programs in California, the US East Coast (RGGI), the European Union (ETS), Switzerland, New Zealand, South Korea, Quebec (whose program is linked with California's, so that permits can be sold across the two jurisdictions), and several provinces of China (currently at the pilot level).[211] Narassimhan et al analyze these programs on five criteria; among others, they identify the ability to take lessons from precedents in other places and

[210] Office of Governor Gavin Newsom, "California Moves to Prevent New Oil Drilling Near Communities, Expand Health Protections," October 21, 2021, https://www.gov.ca.gov/2021/10/21/california-moves-to-prevent-new-oil-drilling-near-communities-expand-health-protections-2/

[211] Easwaran Narassimhan, Kelly S. Gallagher, Stefan Koester, and Julio Rivera Alejo; Carbon Pricing in Practice: A Review of Existing Emissions Trading Systems. *Climate Policy* 2018; 18(8): 967–991

effective allocation of revenues as two of the most important determinants of success.[212] As for their findings on overall performance, Narassimhan et al find that, "relative to other systems, the California–Quebec linked system performs the best in terms of environmental effectiveness, with near full coverage of key emitting sectors including transportation, and a tightening of the cap by three percent every year."[213] California's program ranks high on the sub-criteria of "coverage of key emitting sectors" and "stringency of cap" (compared to medium or low for all others except Quebec's); California is also ranked low for "abatement cost" along with only Quebec and high for "system flexibility," and high for "revenue raised" and "earmarking [of revenues] for distributional equity."[214] Along with Quebec, probably the closest comparison to California's program is RGGI (although it is notably ranked low on coverage of key emitting sectors, as it only applies to the power sector), while the EU and Switzerland rank medium on most sub-criteria. South Korea only ranks high on two sub-criteria and low or medium/low on most of the others, while New Zealand and the Chinese pilots rank low or not applicable on all of them.[215]

Another meta-study by Green, from 2021, examines studies of the performance of cap-and-trade programs and carbon taxes around the world.[216] The merits of a carbon tax, the other major type of market-based mechanism, as compared with cap-and-trade is beyond the scope of this thesis (especially since nowhere in the United States has a carbon tax, nor is that likely to change any time soon), but including jurisdictions with carbon taxes does allow for expanded international comparisons. Countries with a carbon tax as of 2021 include Canada, France, the UK, Mexico, South Africa, and Japan; several Canadian and Mexican provinces also have their

[212] Narassimhan et al 2018, p. 967
[213] Narassimhan et al 2018, p. 983
[214] Narassimhan et al 2018, p. 982
[215] Narassimhan et al 2018, p. 982
[216] Jessica F. Green; Does Carbon Pricing Reduce Emissions? A Review of Ex-post Analyses. *Environmental Research Letters* 2021; 16(4): 043004-1–043004-17

own.[217] In the conclusion of her meta-study, Green points out that "for a policy that has dominated much of the discourse in climate politics, the analysis here demonstrates that collectively, we know relatively little about [emissions pricing's] ex-post performance, and what we do know is concentrated in a few jurisdictions [specifically, Europe]."[218] Overall, Green's analysis attributes only a "limited impact"[219] on GHG emissions to the included emissions pricing systems; however, of the 37 papers included in her meta-study, only two examine California's cap-and-trade program.[220] One is Cullenward's 2014 paper calling attention to resource shuffling (discussed in Chapter Three); however, as it was published only a year after the cap-and-trade program began implementation, it hardly seems to qualify as an ex-post analysis. The other, a 2017 paper by Martin and Saikawa that compares the effect of California's program and RGGI on power sector emissions, finds that California's cap-and-trade program has a greater impact "by an order of magnitude," although it notes that separating the effect of cap-and-trade on the power sector from RPS potentially complicates this conclusion.[221] All in all, Green's review of ex-post analyses reinforces the conclusion that California's cap-and-trade program, for all its difficulties, is outperforming its international counterparts, maybe even significantly so.

In this thesis, I lay out where the cap-and-trade program in California has been successful and where it has fallen short. I point to ways that the program can be strengthened to ensure its economic and political viability as California pursues ever-tougher emissions targets. I would conclude that, as much as the accelerating climate crisis makes an all-of-the-above approach

[217] World Bank, "Carbon Pricing Dashboard"
[218] Green 2021, p. 14
[219] Green 2021, p. 1
[220] Green 2021, p. 6-7
[221] Geoff Martin and Eri Saikawa; Effectiveness of State Climate and Energy Policies in Reducing Power Sector CO_2 Emissions. *Nature Climate Change* 2017; 7: 912–919; p. 913

seem attractive, the limited time available to act on global warming and the extremely contentious politics of climate policy necessitate that such decisions be made strategically, and certain policy choices prioritized over others. This is especially true for California, whose leaders aspire to make the state into a model for the rest of the nation, and indeed the entire world. Towards that end, cap-and-trade has proven itself superior to command and control policies on both the economic and political fronts. Even if there is no policy without its drawbacks, a market-based mechanism like cap-and-trade represents California's, and perhaps even the world's, best hope of sparing future generations from the worst of global warming.