

Cap-and-Invest:

A review of policy, design and models and their applicability in Vermont

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Center for Sustainable Energy

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This paper is produced for the **Energy Action Network (EAN)** as part of the **Vermont Energy Future Initiative**. This report looks at policy options by building on what can be learned from other places that have reduced emissions economy-wide while also improving their economies. EAN is not advocating for a specific cap-and-invest policy but wishes to provide this report to contribute to a more informed conversation of the full set of options for Vermont. The goal is to further the understanding of how Vermont could effectively and equitably deploy auction proceeds from a cap-and-invest system that covers transportation and heating sector greenhouse gas emissions and what it could mean for Vermont's energy, emissions and economic development goals.

The **Center for Sustainable Energy (CSE)** is a mission-driven nonprofit, working as an objective and trusted implementation partner with energy policymakers, regulators, public agencies and businesses of all sizes. Working nationwide, CSE creates smart and connected systems of distributed energy resources and clean transportation for a decarbonized and resilient future.

CSE has long-standing subject and market transformation expertise in renewable energy, clean transportation, building performance and energy efficiency – and understands the policies and regulations that influence their effective implementation.

CSE administers electric vehicle, electric vehicle infrastructure, and auto dealer incentive programs in CT, MA, NY, and CA. CSE's clients and partners benefit from our unique expertise across a wide range of clean energy sectors and our clear understanding of how various technologies and strategies combine to work together to lower energy costs, support resiliency and reduce carbon. Our approach works to deliver consumer choice and integrated solutions required to accelerate the sustainable energy marketplace.

*Energy Action Network (EAN) is dedicated to producing the highest quality research and analysis on a wide range of issues related to meeting Vermont's energy and climate commitments. Linda McGinnis and Karen Glitman are Senior Fellows at EAN. Senior Fellows are leading experts, not employed by any Network member, who are invited by EAN to regularly contribute research and analysis that is relevant to the Network's mission: To achieve Vermont's 90% renewable by 2050 total energy commitment and to significantly reduce greenhouse gas emissions in ways that create a more just, thriving, and sustainable future for Vermonters.

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Table of Abbreviations

AB – Assembly bill
APCR – Allowance price containment reserve
CAD – Canadian dollar
CalEPA – California Environmental Protection Agency
CARB – California Air Resources Board
CCAP – Climate Change Action Plan
CCR – Cost containment reserve
CFTC – Commodity Futures Trading Commission
CGFV – Conseil de gestion du Fonds vert - Quebec Green Fund
CH₄ – Methane
CO₂ – Carbon dioxide
DAC – Disadvantaged communities
ECR – Emissions containment reserve
EITE – Energy-intensive, trade-exposed
GGRF – Greenhouse Gas Reduction Fund
GHG – Greenhouse gas
HFC - Hydrofluorocarbons
JFO – Joint Fiscal Office
MMC – Mine methane capture
MMTCO₂e – Million metric tons CO₂ equivalent
N₂O- Nitrogen oxide
NEG/ECP – New England Governors/Eastern Canadian Premiers
NF₃ - Nitrogen trifluoride
PFCs – Perfluorocarbon
RGGI – Regional Greenhouse Gas Initiative
SB – Senate bill
SF₆ - Sulfur hexafluoride
SO₂ – Sulfur dioxide
TCI – Transportation and Climate Initiative
VCAC – Vermont Climate Action Commission
WCI – Western Climate Initiative

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Executive Summary

The fundamental goal of a cap-and-invest system for greenhouse gas (GHG) emissions is to use market forces to achieve guaranteed emissions reductions at the lowest possible cost. This is achieved by **capping** GHG emissions and **investing** in programs that, when properly designed, help the economy transition as cost-effectively, equitably and quickly as possible. These investments can make compliance even more cost-effective and assist businesses and individuals in adopting low- and non-emitting practices and technologies.

Cap-and-invest policies do not directly assess a price on emissions. Rather than assessing a specific price at the end of the supply chain, market-based mechanisms, like a cap-and-invest system, allow the market to determine the price of the allowances, which are a saleable asset held by the state, private investors, or covered entities. It is important to note that a cap-and-invest program is most effective when it is part of a comprehensive suite of policies that support and incent emissions reductions, economic growth, and equity.

This report explores three North American cap-and-invest systems for reducing GHG emissions, with the goal of providing policy-makers with a better understanding of how cap-and-invest systems work, identifying lessons learned and outlining policy recommendations for creating an economy-wide cap-and-invest system for GHG emissions for Vermont. Specifically, the report looks at the following.

- Regional Greenhouse Gas Initiative (RGGI), in which Vermont currently participates that covers carbon dioxide (CO₂) emissions from electric generation
- California cap-and-invest system, which covers GHG emissions from electric generation, transportation and heating sectors and industrial processes¹
- Quebec cap-and-invest system, which is linked with California through the Western Climate Initiative (WCI) and covers GHG emissions from electric generation, transportation and home heating sectors and industry²

Each of these cap-and-invest systems has demonstrated that a triple win is possible: reduced emissions, increased economic growth and revenue for complementary programs that can accelerate the just transition to a clean energy economy.

Vermont does not need to start with a blank slate: it can build on the work of others. Linking with an existing system greatly reduces startup and administrative costs. That is, Vermont would not need to create a system, stand up an administrative and market structure if it linked with an existing one, or would share these costs if it were part of a larger group of jurisdictions establishing a system. Existing cap-and-invest systems have devised tools, methodologies, and accountability measures that could be

¹ For full list of covered sectors see Section 95811 of the Final Regulation Order May 2018: https://www.arb.ca.gov/cc/capandtrade/capandtrade/ct_reg_2018_unofficialv2.pdf

² http://www.environnement.gouv.qc.ca/changementsclimatiques/marche-carbone_en.asp

replicated, or at least used as a starting point. For example, the Province of Nova Scotia is using the WCI, Inc., platform to manage and track its new cap-and-invest program.

While the three systems have many similarities, there are notable differences that have direct effects on their results. The most notable difference is in the emissions and sectors covered. RGGI covers only CO₂ from electric generation, which accounts for 20% of the region's GHG emissions and 10% of Vermont's emissions. Quebec and California cover GHG emissions³ from the electric, transportation, heating and industrial sectors, accounting for 80%- 85% of their GHG emissions (see Table 1). Another notable difference is price; the RGGI price *ceiling* is \$10.25 while the California price *floor* is \$15.62 (2019).

This report examines each program's system design, investment priorities, market components and program governance. The overview of each program's history, economic and emissions results and investments can be found in the case studies.

The report also highlights lessons learned from these systems and provides policy considerations for the design and implementation of a cap-and-invest system for Vermont. Finally, to assist further conversations, testimony and readings on the subject, the report includes a glossary of terms (Appendix 1).

³ CO₂, CH₄ and N₂O, SF₆, HFCs, PFCs, NF₃ and other fluorinated greenhouse gases.

Table 1 - North American cap-and-invest systems⁴

Cap-and-Invest Systems			
	California	Quebec	RGGI
Sectors Covered	Electricity, Transportation, Heat, Industry	Electricity, Transportation, Heat, Industry	Electricity
% of total GHG covered	80%	85%	20% (region) 10% (Vermont)
Emissions covered	CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, NF ₃	CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, NF ₃	CO ₂ only
Emissions reduction	8% (2012-2016)	2.8% (2012-2016)	40% electric sector (2009-2016)
GDP growth	29% (2012-17) US – 26% (2012-2017)	22% (2012-2016)	21.2% (2009-2017) US - 18.2% (2009-2017)
Proceeds received	\$9.3B in 5 years (2013-2018)	\$2.8B (CAD) in 4 years (2014-2018)	\$2.6B in 10 years (2008-2018)

WCI

As policymakers consider a cap-and-invest system to cover GHG emissions from more sectors, the lessons learned from these systems can provide valuable guidance for how to design a system as well as how to invest auction proceeds to further emissions, economic and equity goals. Following are some key policy considerations.

System Design:

- Equity should be considered in all aspects of program design.
- The more jurisdictions linked by the same system, the greater the market stability, the lower the administrative cost, the broader the impact and the lower the chance of obligated parties moving to a jurisdiction outside the system (known as leakage).
- The more sectors that are covered, the greater the emissions reductions and revenue generated (with the proper cap level).
- The point of regulation should be as far up the supply chain as possible.
- The cap should decrease at a rate that meets climate commitments.
- Market adjustments should be automated for speed, consistency and administrative ease.
- The program should be structured so that it can be linked with existing systems.

⁴ <https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html>

⁴ http://www.dof.ca.gov/Forecasting/Economics/Indicators/Gross_State_Product/

⁴ <https://www.statista.com/statistics/577535/gdp-of-quebec-canada/>

- The entity(ies) administering the program should be trusted and transparent in their dealings.
- Programs should have annual reporting requirements, regular reviews (at least every three years) and maintain flexibility to adjust over time. Third-party verification should be a core principle.
- Protections for energy-intensive, trade-exposed (EITE) industries should be considered to prevent leakage. This is less a concern for the transportation and heating sectors and more a concern for electric and industrial emissions (e.g., paper mills, and concrete plants).
- Require legislative action to withdraw from an established system.

Auction Proceeds and Investments:

- Investments should be concentrated primarily in decarbonizing activities and, as much as possible, walled off from being deposited in general or transportation fund accounts, except for transportation decarbonization programs such as transit, walk and bike programs.
- Investments should be available over the long term to provide markets and businesses with the predictability that can drive innovation.
- Investments should be directed to low- and moderate-income residents and disadvantaged communities to help facilitate a just transition to a clean energy economy. A portion of these investments could be in the form of a carbon dividend based on income and should also include economic development opportunities and job training, as well as greater incentives for efficient and low- to no-carbon heating and transportation options. Incentives could include increases in the earned income tax credit that benefit low-income workers.
- Investing proceeds in research and development can have an important multiplier effect on the economy.

As Vermont policymakers consider the most effective options for meeting climate commitments, the lessons learned from the three successful North American cap-and-invest systems will be critical to designing a low-cost, effective and necessary GHG emissions reduction program. Results from the three cap-and-invest systems covered by this report demonstrate that a cap-and-invest system that cover both broader GHG emissions *and* more energy sectors, in conjunction with complementary policies, are necessary to meet climate commitments, generate new jobs and assist low- and middle-income Vermonters transition to clean energy options.

What is Cap-and-Invest?

Cap-and-invest is an economic model comprised of three main components.

1. **Cap:** Places an annual limit, or **cap**, on pollution.
2. **Allocation:** Requires covered entities to submit one allowance, or permit, for each ton or metric ton of they emit. These allowances are either purchased at auction or allocated freely. Covered entities are incented to require fewer allowances each year by adopting more efficient and cleaner processes. Allocations decrease over time in conjunction with a declining cap.
3. **Invest:** Proceeds from the auction are **invested** in complementary programs that can further reduce emissions and the impacts they produce.

The cap places an absolute limit on pollution that declines over time, providing pollution reduction certainty. A jurisdiction must have a pollution reporting system in place to begin this process.⁵ It is from these data that allowances to obligated entities are determined. The size of the cap determines the number of allowances allocated to covered entities (e.g., an 80 MMTCO₂e⁶ cap on emissions, where each allowance is equivalent to 1 metric ton, equals 80 million allowances).

Each covered entity is required to submit (i.e., retire) allowances equal to its allocated emissions cap for the given compliance period to the implanting agency.⁷ This can be achieved in the following ways.

- By reducing their emissions (e.g., by investing in efficiency or switching to cleaner fuels)
- By purchasing allowances through an auction or from a third party
- By purchasing offsets
- By a combination of all three

There is an incentive for covered entities to reduce their emissions below their cap as they can then sell their emissions savings to others seeking allowances or avoid the need to purchase them. In some program designs, identified industries, usually EITE ones, receive some or all their allowances for free from the government.

The auction mechanism in a cap-and-invest system allows the market to determine the price of the pollution and to drive efficiencies in emissions reductions.

⁵ Vermont's GHG inventory (<https://dec.vermont.gov/air-quality/climate-change>) relies on reporting and analysis through the U.S. EPA National Emissions Inventory (<https://www.epa.gov/air-emissions-inventories/national-emissions-inventory-nei>). Entities that emit more than 25,000 MMTCO₂e are required to report their emissions. In addition, under the Community Right to Know Tier II, facilities that handle or store more than 100 pounds of petroleum are required to report their location and amount of product. <https://vem.vermont.gov/programs/epcra>

⁶ Million metric tons of CO₂ equivalent.

⁷ For WCI this is done through the Compliance Instrument Tracking System Service (CITSS). For RGGI it done through the RGGI CO₂ Allowance Tracking System (RGGI COATS)

This system allows for efficient price discovery⁸ of the least-cost means of keeping emissions below the cap. It is technology neutral and, importantly, generates revenue to achieve policy goals related to eliminating the targeted pollution and the impacts it produces.

The cap provides pollution reduction certainty, but the market mechanism of an auction does not provide revenue certainty. Setting an auction floor price can provide a minimum revenue guarantee. It is from the purchase of allowances at auction that revenue is generated. The amount of that revenue is dependent on the number and value of the allowances.

Cap-and-invest systems are currently used to reduce pollution in more than 50 jurisdictions around the world, covering more than 1 billion people.⁹

There is an important distinction between cap-and-trade and cap-and-invest policies. A cap-and-trade system generates no proceeds or revenue through auction. An example of such a system is the one developed to reduce acid rain. Successfully used since 1990 to reduce sulfur dioxide (SO₂), the pollution that causes acid rain, it requires polluters in the electric power sector to operate under an SO₂ cap, but it does not have an auction of allowances to generate revenue for further investments.¹⁰

The Regional Greenhouse Gas Initiative (RGGI) uses a cap-and-invest system to reduce emissions from electric generating plants in nine northeastern states. Similarly, California and Quebec have a joint auction system that is administered by the Western Climate Initiative (WCI) and encompasses emissions from electric generation, heating fuels, transportation and industry. RGGI, Inc. and WCI, Inc. administer regular auctions of allowance that generate revenue that are invested in programs that further meet emissions, economic and equity goals.

Cap-and-invest systems do not dictate how a covered entity needs to operate to meet its obligations. If an entity emits less than its allowance levels, it can either sell its excess allowances or bank them for future use, in accord with the design of the program. This places a monetary value on the reduced emissions by creating a new revenue stream through the sale of unused allowances. This gives participating entities the incentive to more rapidly reduce their pollution.

A long-term cap-and-invest system with adequate price containment mechanisms provides investors with the certainty that enables long-term investments. This is important as one of the goals of a cap-and-invest system is to encourage covered entities to adopt new technologies and processes to reduce or eliminate their emissions in alignment with policy goals.

Cap-and-invest systems create a marketplace for trading allowances, as seen in Figure 1. Cap-and-invest administrators set the rules, including the level and rate of reduction of the cap.

⁸ Price discovery refers to economic activity, such as a auctions and trading in secondary markets, that reveal the value or price of a good. When an item is put up for sale or trade, the market will dictate its value, leading to price discovery.

⁹ https://carbonpricingdashboard.worldbank.org/?cid=ECR_TT_worldbank_EN_EXT

¹⁰ <https://www.epa.gov/airmarkets/acid-rain-program>

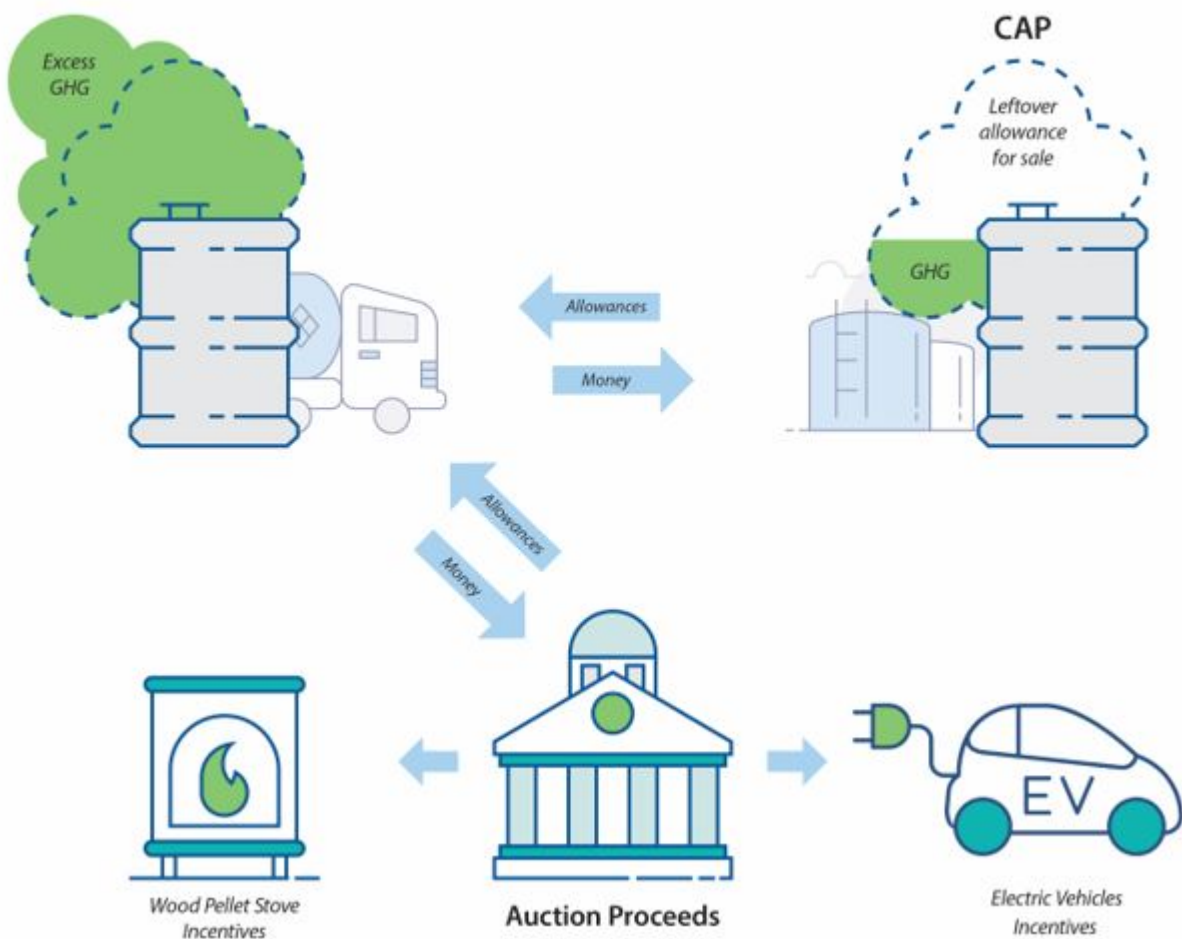


Figure 1 – GHG cap-and-invest system illustration

Most cap-and-invest systems include a price floor, like a reserve in a traditional auction, e.g., in real estate auctions. This guarantees a base level of revenue. Market managers can incorporate levers to support a vibrant market as values reach the price floor, such as reducing the cap through what is called the emissions containment reserve. If prices in the market approach or reach the established price floor and the system includes an emissions containment reserve, the market system can automatically reduce the supply of allowances available at auction, thus putting upward pressure on prices.

Market stability and predictability also can be enabled through price ceilings. This sets an upper limit for the price of allowances sold at auction. As with emission containment reserves that stabilize the market if prices reach a floor level, market managers can incorporate levers to support market stability if prices hit a price ceiling. This can include the release of allowances to cool the market, known as a “cost containment reserve.” By increasing the supply of allowances market prices are tempered.

The price corridor is the range between the price floor and the price ceiling that allowance trade within. The price collar is the maximum of the price ceiling and price floor. Figure 2 illustrates the role of these market structures.

Cap-and-Invest: Market Components

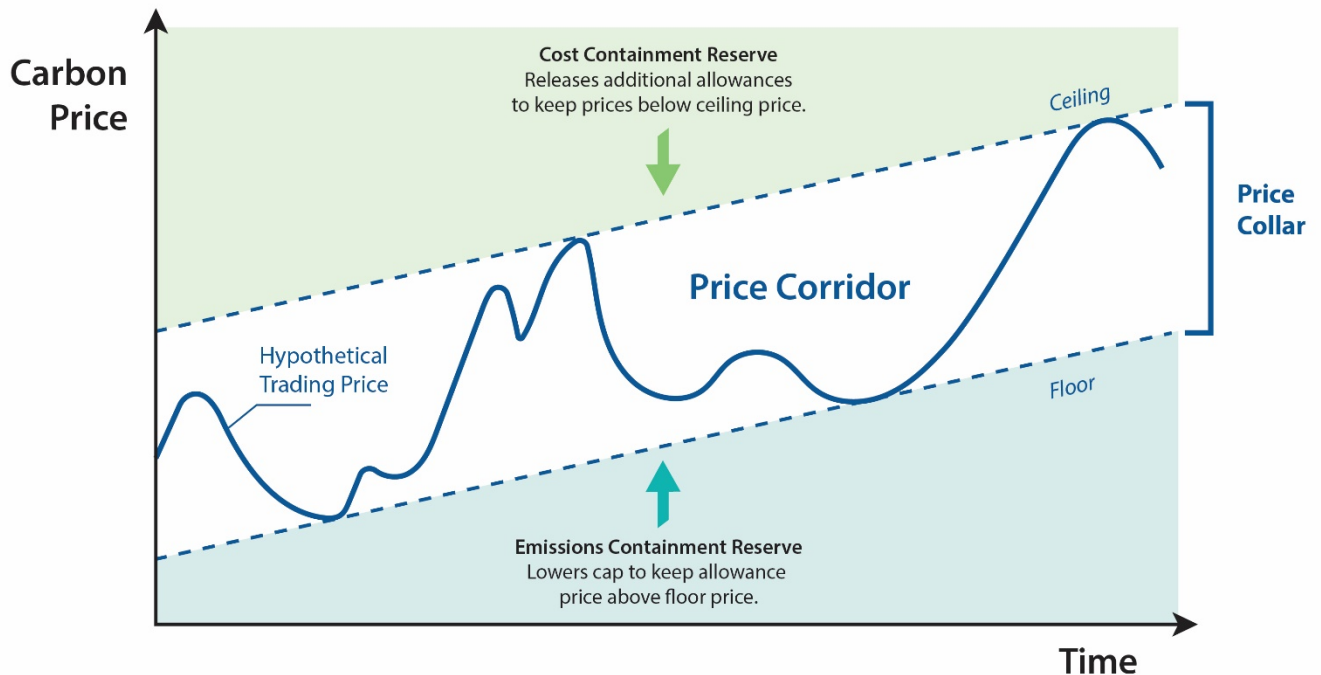


Figure 2 – Cap-and-invest: market components

The proceeds generated from the auction represent a long-term source of critical revenue to invest in complementary policies and programs. This provides a critical multiplier effect to further reduce GHG pollution while protecting vulnerable populations. The predictable nature of this revenue allows for the creation of long-term programs and sends a powerful signal to investors, consumers and entrepreneurs to adopt low- and no-emissions technologies.

Depending on how they are deployed, cap-and-invest auction proceeds can serve multiple purposes.

- Meet state climate policy goals through investment in complementary policies and programs directed at reducing GHG emissions (e.g., increased weatherization, renewable heating incentives, electric public transportation, EV incentives, etc.)
- Protect and support vulnerable populations in the transition to a clean energy economy, and enable people and communities to deal with the impacts of climate change
- Invest in research and development to further innovation toward GHG reductions
- Protect the natural and built environment to reduce vulnerability to the impacts of climate change

Establishing a Cap-and-Invest System

Cap-and-invest is a flexible market mechanism that facilitates low-cost emissions reductions, enabling investment in programs and projects that meet the jurisdictions' policy objectives, such as energy efficiency, affordable clean transportation options and clean economy jobs. It has three key components.

Cap Pollution

- An annual cap, or a maximum limit on pollution, is set by the implementing agency or legislature.
- Over time, the cap is lowered, which means less pollution and more health, economic and environmental benefits
- The cap is partitioned into emission allowances, with one allowance representing the authority to emit 1 metric ton of pollution

Allowances

- Emissions allowances are a new commodity. Policymakers can decide to distribute them at no cost (free allowances), sell them through an auction or use a combination of strategies. Every entity subject to the program is required to surrender allowances equal to its cap at a set compliance point.
- Once circulated into the market via allocation and/or auction, allowances can be traded amongst participants on the secondary market.
- If a covered entity succeeds in reducing its emissions, it can sell its allowances.
- If a company emits too much, it needs to purchase allowances through the auction process or secondary market or purchase offset credits or a combination of these.
- Companies/organizations outside the cap that have verified emissions reductions or carbon capture can also sell allowances in the form of offsets. They also can buy allowances for future sale, providing liquidity to the market.
- At the end of each compliance period, covered entities surrender emission allowances to the implementing agency to cover the number of tons emitted. If a covered entity does not provide enough allowances, it is subject to penalties.
- Cap-and-invest systems can provide flexibility through the distribution of free allowances to vulnerable populations or industries. For example, Québec offers free allowances to some industries that are significantly exposed to trade. California provides allowances to investor owned utilities (utility consignment) that must be placed in auction, the proceeds of which are designed to protect low-income ratepayers from bill increases.

The portion of allowances that are not placed in auction could be considered a cap-and-trade provision within a cap-and-invest system. For instance, free allowances provided to EITE industries do not result in auction proceeds and could be considered purely cap-and-trade, even though they are part of a broader cap-and-invest system.

Invest in Jobs, Innovation, Affordability

- Proceeds generated from the allowance auction can be used to reinvest in activities that further reduce pollution and meet additional state policy objectives as determined by legislative authority

- Examples include: 1) programs that reduce energy costs, create jobs, improve air quality and cut GHG pollution; 2) direct rebates based on income, geography, or other factors; 3) programs targeted to assist vulnerable populations through reduced energy costs and incentives to increase access to clean energy options for their homes, businesses and transportation; 4) investment in research and development to generate more innovation and greater pollution reduction; and 5) programs to meet other state policy objectives that can generate a multiplier effect on pollution reduction

The key steps¹¹ to establish a cap-and-invest system are shown in Figure 3. Some steps may occur concurrently.

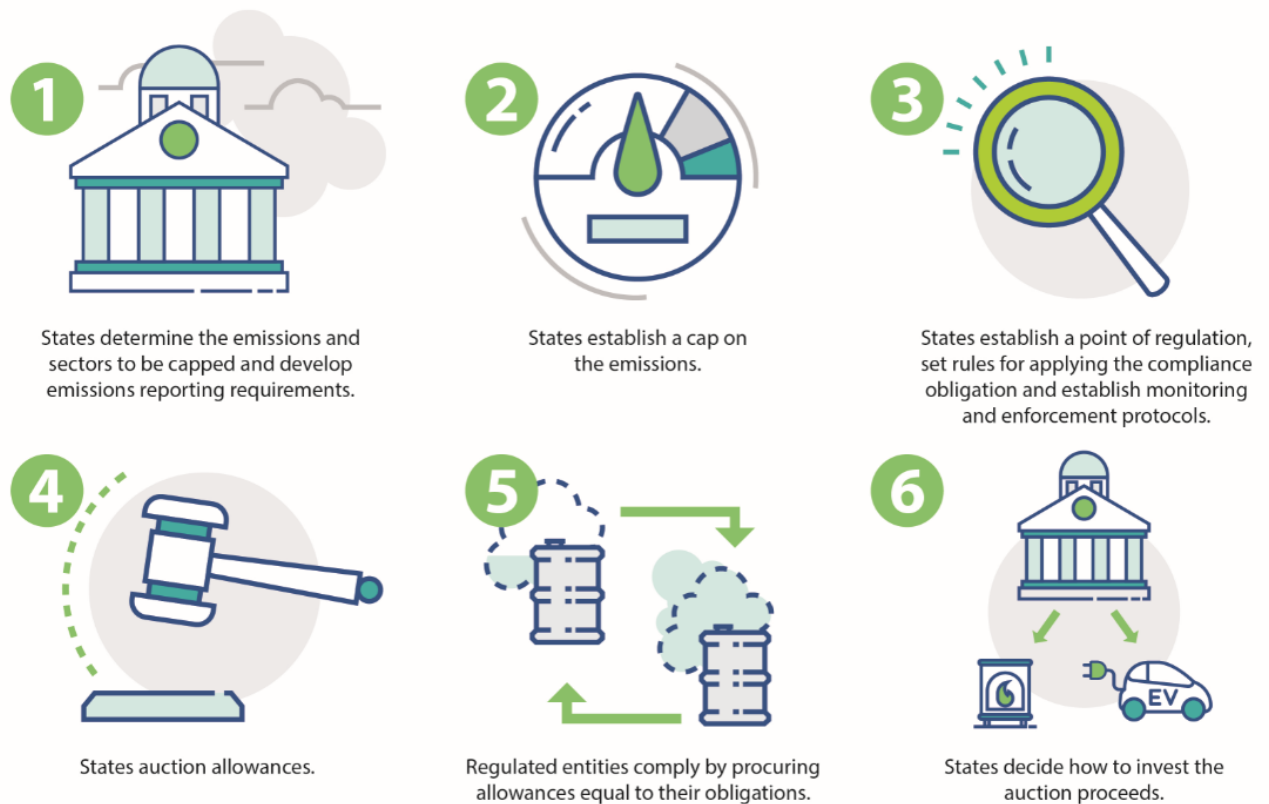


Figure 3 - Elements to establish a cap-and-invest system

¹¹ **Vermont** statute creating RGGI: <https://legislature.vermont.gov/statutes/section/30/005/00255>

Vermont regulations creating RGGI: https://dec.vermont.gov/sites/dec/files/agc/laws-regs/documents/Vermont_CO2_Budget_Trading_Program_Rule_adopted_08292018.pdf

Quebec's regulation creating program: <http://legisquebec.gouv.qc.ca/en/pdf/cr/Q-2,%20R.%2046.1.pdf>

California's current program regulation: https://www.arb.ca.gov/cc/capandtrade/capandtrade/ct_reg_2018_unofficialv2.pdf

Proposed **Massachusetts** legislation creating program: <https://malegislature.gov/Bills/191/SD1541>

Vermont History – GHG Emissions Reductions

Vermonters have consistently recognized the environmental challenges facing the state and have taken actions to address them. From the billboard law, bottle returns and Act 250, Vermont has a long history of tackling the challenges of the day with the passage of environmental legislation. While its history of environmental leadership is well established, Vermont has been less successful in addressing GHG emissions.

The state failed to meet its legislated GHG reduction goals and increased its emissions over the 1990 baseline year (Figure 4). Although Vermont is making progress in adopting renewable electricity generation, without significant policy shifts addressing the transportation and heating sectors, Vermont will fall even further behind. Together the transportation and heating sectors comprise 71% of Vermont’s GHG emissions. Only so much additional progress can be made by focusing on electricity emissions alone.

As shown in Figure 4, the reduction pathways required have grown steeper and the timeframe in which to act has shortened since these commitments were first made.

What will it take to meet our commitments?

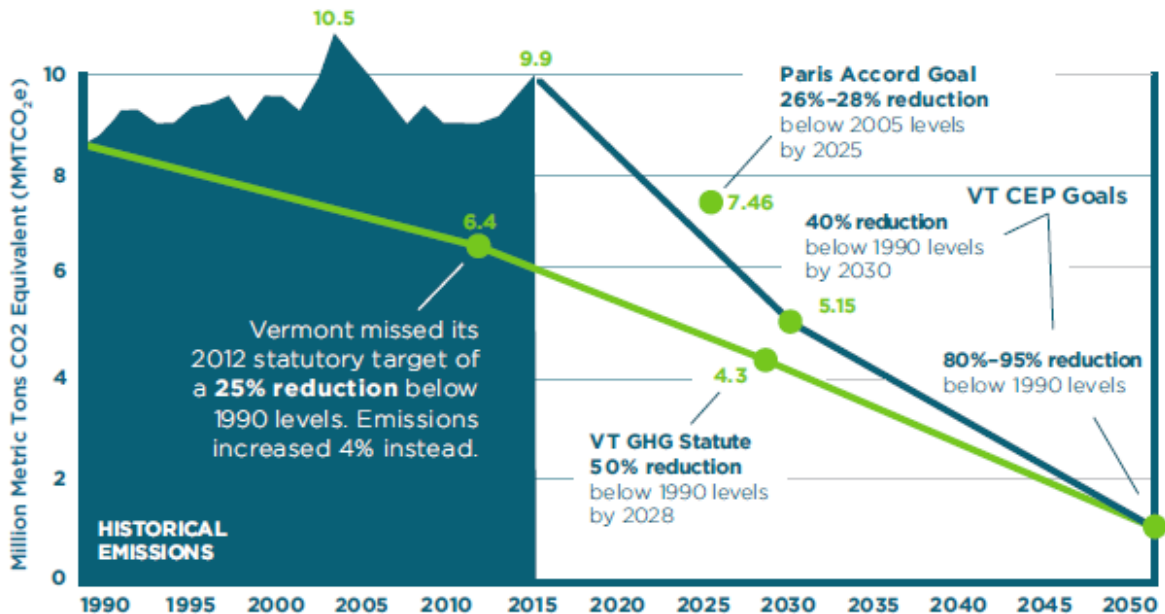


Figure 4 - Vermont GHG emissions reduction commitments (EAN, ANR GHG emissions inventory)

While Vermont has policies related to reducing GHG emissions from the electricity sector, including RGGI, a renewable energy standard and energy efficiency requirements, GHG emissions from electricity are higher in 2015 than at any time prior to 1992. This can be attributed to Vermont Yankee Nuclear

Power Station retiring in 2011 rather than an increase in electricity use. As shown in Figure 5, the electricity sector represents 10% of Vermont’s overall GHG emissions. The greatest contributors to Vermont’s GHG pollution are the transportation and heating sectors, representing 43% and 28% respectively.

As seen in Table 2, Vermont has made several GHG reduction commitments.

Table 2 - Vermont GHG reduction commitments¹²

VT GHG Reduction Commitments					
	2012	2025	2028	2030	2050
Below 1990 Levels (CEP targets)				40%	80-95%
Below 2005 levels	37% (statutory goal)	26-28% (Paris Accord Commitment)	58% (statutory goal)	45-54% (NEG/ECP agreement)	79% (statutory goal)

¹² US Climate Alliance “we’re still in” targets to meet Paris Accord (June 2017). <https://governor.vermont.gov/press-release/bipartisan-group-governors-leading-climate-change>

¹² 10 V.S.A. §578

¹² New England Governors and Eastern Canadian Premiers (NEG/ECP) (August 2015) <http://www.cap-cpma.ca/data/Signed%2039-1En.pdf>

¹² 10 V.S.A. §578

Vermont's GHG emissions by sector

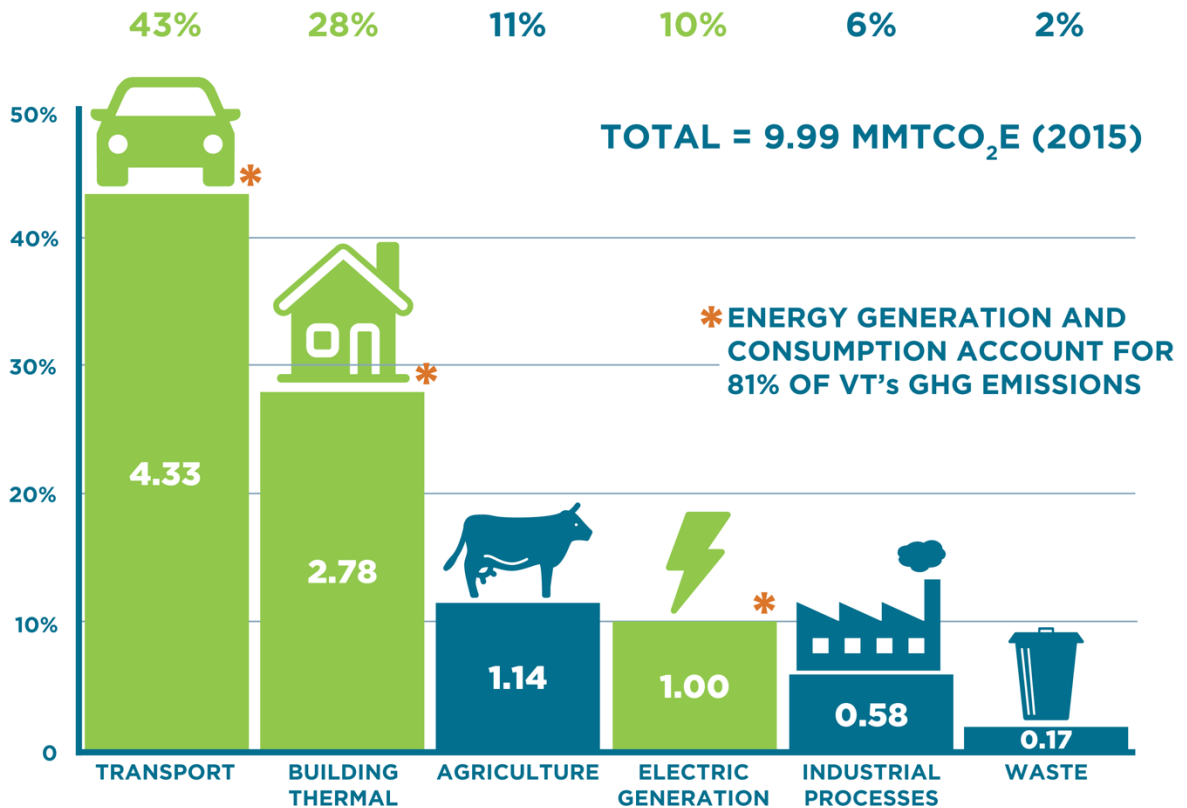


Figure 5 - Vermont GHG emissions by sector (EAN, ANR GHG emissions inventory)

Of relevance to this report, in the same 2005 law that established Vermont's GHG reduction goals, a provision was included calling on the Public Utility Commission, the Secretary of Natural Resources and the Commissioner of Public Service to advocate for a regional or national "cap-and-trade program for greenhouse gases, **including those caused by transportation, heating, cooling and ventilation** (emphasis added)."¹³ It further stated that this may take the form of an expansion of the existing Regional Greenhouse Gas Initiative (RGGI), or it may entail the creation of an entirely new and separate regional or national cap-and-trade initiative that includes a 100% consumer allocation system.

In June 2017 Governor Phil Scott signed on to the US Climate Alliance, a bipartisan coalition committed to meeting the goals of the Paris Climate Agreement. This commitment requires Vermont GHG emissions to be reduced by 26-28 percent from 2005 levels by 2025.

In July 2017, Governor Phil Scott created the Vermont Climate Action Commission (VCAC), a group of 21 representatives from for-profit and nonprofit organizations and various state, regional and local government agencies. The Governor's Executive Order identified the commitments found in the 2016

¹³ 10 VSA §578(d)

Comprehensive Energy Plan to reduce GHG emissions by at least 40% below 1990 levels by 2030 as a foundational reason for the following charge to the VCAC.

“ . . . draft and recommend, for the Governor’s consideration, an action plan aimed at reaching the State’s renewable energy and greenhouse gas reduction goals while driving economic growth, setting Vermonters on a path to affordability, and ensuring effective energy transition options exist for all Vermonters.”¹⁴

VCAC issued their recommendations on July 31, 2018. One of the recommendations, to study “regulatory and market decarbonization mechanisms” with the aim of better understanding various policy approaches for reducing greenhouse gas (GHG) emissions in Vermont, was furthered in Act 11 (2018). This act provided funding and a directive to conduct a study of carbon pricing mechanisms, including both a carbon tax and cap-and-invest.

This study, entitled *Analysis of Decarbonization Methods in Vermont*, conducted for the Joint Fiscal Office (JFO), by Resources for the Future (RFF), found that “combining moderate carbon pricing and non-pricing policy approaches could reduce emissions to meet Vermont’s US Climate Alliance target. . .”¹⁵

More than 85% of the policies reviewed by the study require revenue to implement. A cap-and-invest system could be designed to provide indirect carbon pricing and the revenue to fund complementary programs.

Regional Greenhouse Gas Initiative

In 2005 Vermont joined nine other states¹⁶ in establishing a cap-and-invest system through the Regional Greenhouse Gas Initiative (RGGI) to address CO₂ emissions from the electricity sector, the most widely price-regulated energy sector. RGGI administered its first auction of CO₂ emissions allowances in 2008. RGGI presently includes nine states and is soon to be expanded to include two more, New Jersey (rejoining) and Virginia.

A description of RGGI benefits and results are detailed in the RGGI case study.

Transportation and Climate Initiative

The Transportation and Climate Initiative (TCI) builds on the regional collaboration that led to the establishment of RGGI and looks to tackle the more than one-third of GHG emissions that come from the region’s transportation sector. TCI is a collaboration of 12 Northeast and mid-Atlantic states and is facilitated by the Georgetown Climate Center.¹⁷

¹⁴ Executive Order No. 12-17: <https://governor.vermont.gov/sites/scott/files/documents/EO%2012-17%20-%20Climate%20Action%20Commission.pdf>

¹⁵ https://jifo.vermont.gov/assets/Uploads/f7d068947e/DecarbonizationMethodsVT_Report_7.pdf (p. 1)

¹⁶ Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and New Jersey (which left in 2012 and is seeking to rejoin in 2019).

¹⁷ Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Virginia.

TCI conducted listening sessions between March and August 2018 to identify policy considerations for addressing GHG reductions in the transportation sector. Of relevance to this report is the consistent finding that identifying long-term, sustainable funding mechanisms that can be used to implement policies at the state and regional level are needed to achieve GHG emissions reduction goals.¹⁸

In December 2018, Vermont joined nine other jurisdictions¹⁹ in committing to design, by the end of 2019, a new regional cap-and-invest system that would cap and reduce GHG emissions from the combustion of transportation fuels and invest proceeds from the program into low-carbon and more resilient transportation systems, options and infrastructure.

Heating Fuels Sector

There is no parallel initiative to TCI to cap emissions in the heating fuels sector. As noted earlier, both Quebec and California's linked cap-and-invest systems (through WCI) addresses emissions from electricity, transportation, heating and industry. It is possible for a jurisdiction to participate in separate cap-and-invest systems for different sectors, for instance, participating in RGGI for electricity, TCI for transportation and WCI for heating.

Regulating emissions from transportation and heating combustion present different challenges from regulating emissions from electricity generating units that already operate in a price-regulated environment. A cap-and-invest system that covers transportation and/or home heating fuels would create price regulation in sectors that have only known safety, environmental and tax collection regulations.

Addressing emissions from heating, which account for 28% of Vermont GHG emissions and 25% of Vermonters energy cost,²⁰ and from transportation, which accounts for 43% of Vermont GHG emissions and 52% of Vermonters energy cost,²¹ can be further narrowed to the highest targets for emissions and energy cost reductions. For instance, covering gasoline and diesel GHG emissions for transportation would cover 86% of emissions from the transportation sector.²² Covering oil, propane and natural gas GHG emissions for heating would account for 94% of Vermont's thermal emissions.²³ Off-road, aviation, marine fuels and more minor transportation fuels such as CNG, LNG and propane could be brought under regulation later.

¹⁸https://www.transportationandclimate.org/system/files/TCI%20Listening%20Session%20Summary%20Report_11-14-2018.pdf

¹⁹ Connecticut, Delaware, Maryland, Massachusetts, New Jersey, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington, D.C.

²⁰ <https://www.encyvermont.com/Media/Default/docs/white-papers/efficiency-vermont-mapping-energy-burden-vermont-white-paper.pdf>

²¹ Ibid.

²² https://dec.vermont.gov/sites/dec/files/agc/climate-change/documents/Vermont_Greenhouse_Gas_Emissions_Inventory_Update_1990-2014.pdf

²³ Ibid.

Vermont-Specific Policy Considerations

Vermont can significantly, quickly and cost-effectively reduce emissions while improving population health and the economy. The JFO report, recommendations from the VCAC and statutory and executive branch commitments make it clear that the state can and must adopt policies that accelerate the just transition to a clean energy economy. This section focuses on the considerations that are specific to Vermont when determining how to structure a cap-and-invest system for transportation and heating GHG emissions.

Flow of Fuels

Vermont's relatively small size and nonexistent fossil fuel production and refining industries mean that it is at the end of the fossil fuel supply chain, which presents different options for regulating entities. Fossil fuels enter Vermont through pipelines, trucks and rail. Natural gas arrives via pipeline from Canada. Petroleum products transit through Vermont between Quebec and Maine via the Portland pipeline, but there is no terminal located in Vermont from which to distribute fuel from the Portland pipeline.

Propane enters Vermont by rail car and truck transport. Propane is delivered by rail to wholesale terminals in Berlin, VT; Hampton, NY; Claremont, NH; and Rockingham, VT and picked up by truck by propane retailers to be distributed to Vermont homes and businesses. While these are significant wholesale terminals, propane retailers also obtain supplies by rail and truck transport from facilities throughout the Northeast depending on contracts, pricing and availability. Approximately 50 bulk propane storage facilities exist in and around Vermont that are owned by fuel retailers to distribute propane. Propane is delivered to these privately owned bulk storage facilities by rail and truck transport.

Most of the gasoline and distillate²⁴ consumed in Vermont comes from regional wholesale terminals in Vermont, Canada, New York, Massachusetts and New Hampshire. Gasoline and distillate enter Vermont by rail car and truck transport. There are two wholesale terminals in Burlington and terminals in Essex, Rutland and Hartford. The rail facility in North Walpole, New Hampshire, is accessed by distillate retailers operating in south eastern Vermont. While these are significant wholesale terminals for Vermont retailers of gasoline and distillate, retailers also obtain supplies by rail and truck transport from other facilities throughout the Northeast depending on contracts, pricing and availability. There are approximately 75 bulk storage facilities in and around Vermont that are owned by fuel retailers to distribute distillate product. Fuel is delivered to these privately owned bulk storage facilities by rail and truck transport.

The multijurisdictional nature of how fossil fuels enter the state must be considered as regulations are determined for a cap-and-invest program. Compliance and enforcement considerations would need to be considered if the point of regulation is out of state or in Canada.

²⁴ Heating oil, diesel and kerosene

Canadian Imports

Canadian energy imports into Vermont totaled \$889 million in 2017. Most of this is from electricity imports. Having Vermont's primary trading partner participating in a cap-and-invest system provides some impetus for Vermont to follow suite. As businesses consider how to price their goods, Quebec's cap-and-invest system is likely reflected in the prices of Vermont's imports from Quebec. Quebec's participation in a cap-and-invest system may also provide some avenues for compliance and enforcement if the point of regulation is located there.

Supply Chain Actors

Vermont has 108 motor fuel distributors and 163 diesel fuel distributors.²⁵ There are a total of 245 unique distributors for gasoline and diesel,²⁶ 433 gasoline fueling stations and 126 retail fuel deliverers of oil, propane, natural gas and coal. There are four CNG stations for transportation and two liquified petroleum gas fueling stations.²⁷ Vermont has one bulk terminal in Burlington and 11 bulk stations and terminals for gasoline and diesel.

Vermont follows the EPA GHG reporting requirements²⁸ that cover seven Vermont entities. In addition, under the Community Right to Know Tier II, facilities that handle or store more than 100 pounds of petroleum are required to report their location and amount of product.²⁹ These reporting requirements provide additional insight into potential points of regulation.

Having the point of regulation covering fewer and larger entities can ease the administrative burden. Larger entities are more accustomed to dealing with regulations. As shown in Figure 6, a couple of key points could serve as the point of regulation in Vermont.

²⁵ Personal correspondence with Donna Earle, VT DMV February 19, 2019.

²⁶ https://www.georgetownclimate.org/files/report/GCC_TransportationFuelSystemConsiderations_July2018.pdf (p. 21)

²⁷ <https://www.eia.gov/state/data.php?sid=VT#SupplyDistribution>

²⁸ 25,000 MMTCO₂e

²⁹ <https://vem.vermont.gov/programs/epcra>

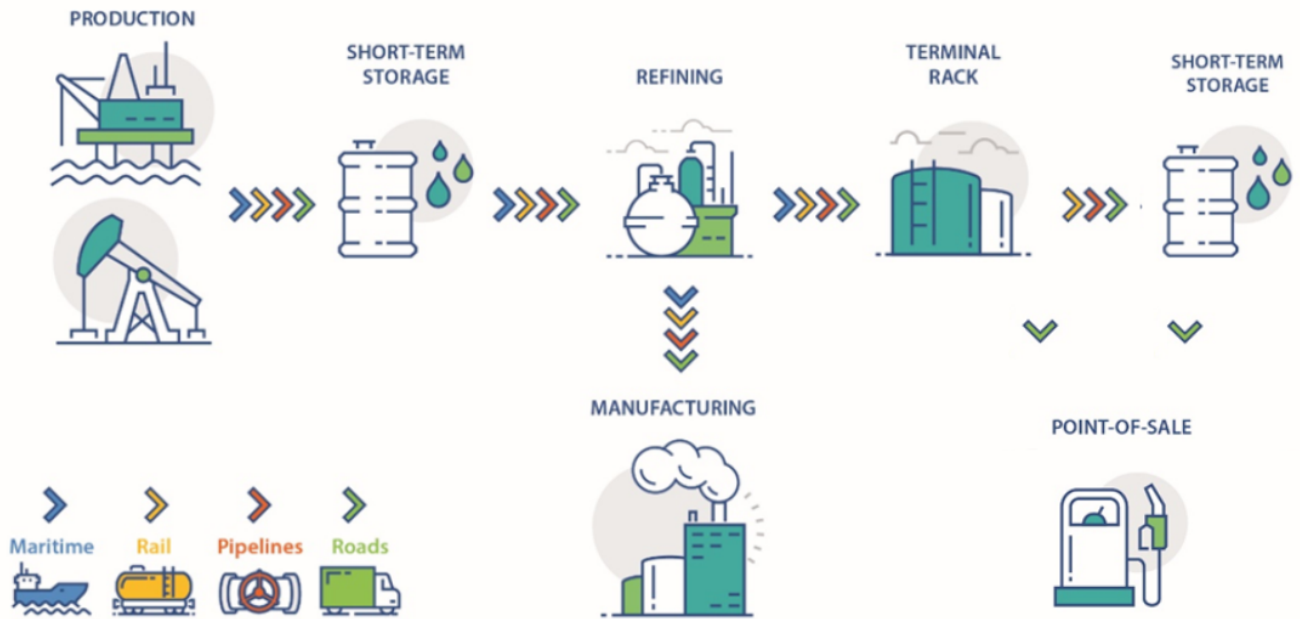


Figure 6 - Fossil fuel supply chain

About three-fifths of Vermont households rely on fuel oil, propane or kerosene to heat their homes³⁰ and 99% of all Vermonters³¹ rely on fossil fuels for transportation.

Point and Rate of Existing Taxation of Heating and Transportation Fuels

Vermont assesses a **motor** fuel tax (transportation) and a fuel tax (heating). The motor fuel tax is assessed to entities that purchase fuel from the terminal rack and distribute it to retailers. These entities are called “distributors.”³²

Motor fuel distributors currently collect an assessment on gasoline in the amount of 2% of the state average retail price, exclusive of federal and state taxes, upon each gallon sold by the distributor.^{33,34}

³⁰ U.S. Census Bureau, American FactFinder, Vermont, Table B25040, House Heating Fuel, 2016 American Community Survey 1-Year Estimates.

³¹ Based on less than 1,000 all-electric vehicles registered.

³² “Distributor” shall mean a person, firm or corporation who imports or causes to be imported gasoline or other motor fuel for use, distribution or sale within the state, or any person, firm or corporation who produces, refines, manufactures or compounds gasoline or other motor fuel within the state for use, distribution, or sale. <https://dmv.vermont.gov/commercial-services/diesel-fuel-tax>

³³ The state average retail price, as determined by the Department of Public Service, will be used to set the rate on a quarterly basis using the prior three-month averages. The Department of Motor Vehicles will calculate the amount of the assessment for each upcoming quarter and notify the distributor in advance of the rate that will be in effect.

³⁴ The rate: **\$0.0469** (January - March 2019) <https://dmv.vermont.gov/commercial-services/diesel-fuel-tax/mftia-mfta-quarterly-fees>

Beginning January 1, 2019, distributors separately record and report gasoline sold for aviation purposes.³⁵ Funds collected on the sales and use of aviation gasoline are to be exclusively used for aviation purposes.

Vermont assesses the fuel tax to entities who make retail sales of delivered fuel to residences or businesses at a rate of \$0.02 per gallon. Fuels considered under this tax include heating oil, propane, kerosene and other dyed diesel fuels. Additionally, there is a gross receipts tax on coal and natural gas at a rate of 0.75%.³⁶

There are 126 retail fuel deliverers of oil, propane, kerosene, natural gas and coal serving Vermont.³⁷

Potential Revenue from Cap-and-Invest System

The *Analysis of Decarbonization Methods in Vermont* report shows that a cap-and-invest system in Vermont could yield between \$62.1 million and \$99.4 million (in 2015 dollars) in 2020, as shown in Figure 7.

Annual Gross Carbon Revenues by Sectoral Coverage			
Millions (2015\$)			
Sectoral coverage	2020	2025	2030
Economy-wide (electricity exempt)	99.4	120.8	147.0
Transportation and heating	94.1	114.3	138.9
Transportation only	62.1	74.7	89.6

Note: Carbon pricing design: WCI price path, lump-sum rebates, Vermont only.

Figure 7 - Annual gross carbon revenues by sectoral coverage (RFF)³⁸

Policy Objectives

Vermont has several statutory policy objectives that should be considered in both program design and investment decisions. Policy objectives regarding energy, public health and economic development are the most directly related to reducing GHG emissions. Policymakers should set clear direction to program

³⁵ 23 VSA §3105(a)(2).

³⁶ <https://tax.vermont.gov/sites/tax/files/documents/TaxationofFuelsFS.pdf>

³⁷ <https://dcf.vermont.gov/sites/dcf/files/ESD/Docs/Fuel/Fuel-Dealers.pdf>

³⁸ <https://legislature.vermont.gov/Documents/2020/WorkGroups/House%20Natural/Decarbonization/W~Marc%20Hafstead~Decarbonization%20-%20Final%20Report~1-22-2019.pdf>

developers on the high-level outcomes they want the investments to achieve. These funds can help grow economic activity in the state and improve economic and health outcomes if programs are designed with those outcomes at the fore. For instance, targeting more investments for transportation electrification initiatives in highly energy-burdened communities or areas with high asthma rates helps ensure geographic equity and can improve energy affordability and health.

Including research and development programs funded by auction proceeds can help encourage entrepreneurship and strengthen colleges and universities if they are recipients of those funds.

Cap-and-invest programs should be evaluated on a regular basis,³⁹ have annual reporting requirements and third-party review of their costs and benefits.

Cap-and-invest programs should collect data and obtain feedback from participants to inform future program design. Program design should be data informed and consider performance-based incentives for program administrators. For instance, a program administrator would receive a performance incentive not for the number of incentives they deliver but for GHG they reduce, leading them to also search for the most cost-effective GHG reduction strategies.

Programs should be visible and transparent and include user-friendly application processes, outreach, marketing and promotion. Designing programs with the customer at the center can help ensure that there is market uptake of the promoted activity. Providing transparency of aggregate data collected⁴⁰ for policymakers, innovators and entrepreneurs can lead to improved program design and policy changes.

Governance Models

Policymakers should decide if they want development of programs and the disbursement of revenue to support the policy objectives to flow through the regular legislative budget process and, if so, at what level (broad program directives or specific projects) or to be held by a quasi-public entity like the Quebec Green Fund.

- Vermont RGGI funds are directed by 30 V.S.A. § 255 (d) to be deposited into the electric efficiency fund created under 30 V.S.A. § 209(d)(3) and to be used to help meet the building efficiency goals established under 10 VSA §581 by delivering heating and process-fuel energy efficiency services.
- California revenues are broadly appropriated to state agencies who develop the programs and projects in support of AB 32 and SB 32 objectives.
- Quebec revenues are directed by the Green Fund Board in support of the 2013-2020 Climate Change Action Plan.

³⁹ Many programs have three-year review cycles.

⁴⁰ E.g., aggregated socio-demographics and geolocation of activity.

In both California and Quebec government agencies develop programs to meet the goals established in their planning processes. As shown in their case studies, the range of programs supported by auction proceeds encompass a broad spectrum of activities: transportation, affordable housing, wetlands, health, resiliency, etc. Relevant state agencies with the expertise necessary to develop, implement and evaluate programs in their fields are likely best suited for this role. The management of the auction proceeds in a separate fund is likely necessary for accounting and transparency purposes.

The keys to success in any of these models is to have an open and transparent process for the public and market participants to easily participate in programs, have faith and trust that the funds are being used as intended and determine if the programs and projects funded deliver on their goals.

General Policy Considerations

As policymakers consider mechanisms to cap and reduce GHG emissions, it is helpful to consider lessons learned from the three North American cap-and-invest systems reviewed in this report. Each of these cap-and-invest systems has demonstrated that a triple win is possible: reduced emissions, increased economic growth and revenue for complementary programs that can accelerate a just transition to a clean energy economy.

The lessons learned from these systems can provide valuable guidance for both how to design a similar system in Vermont, as well as how to direct the proceeds generated from the auction to further emissions, economic and equity goals.

The recent *Analysis of Decarbonization Methods in Vermont* report,⁴¹ states that Vermont can make the most substantive progress toward its climate goals by combining *both* pricing and complementary nonpricing policies. Given that nonpricing policies require revenue to implement, a cap-and-invest system provides mechanisms to both put a cap on GHG pollution and generate revenue to fund key complementary climate policies and programs.

Another value of a cap-and-invest system is its ability to catalyze private sector revenue. To date, California's investment process has attracted \$8.2 billion of private capital resulting in a leveraging ratio of \$1 to \$4.10.⁴²

A goal of a GHG cap-and-invest system is to incent businesses and society to adopt low and non-emitting practices in time to solve the climate crisis. By placing a cap on GHG pollution, declining each year, cap-and-invest creates certainty in meeting GHG reduction goals. An auction of allowances, with a declining cap, creates an opportunity to generate revenues to invest in programs that can further accelerate a just transition to a clean energy economy. Political signals can influence investment decisions and anticipation may lead affected industries to act earlier.

Drawing on the lessons learned from the three North American cap-and-invest systems, this section outlines key considerations for Vermont policymakers across three categories: general, system design and investments.

General

Equity

Programs should be designed with equity considerations in how funds are raised, the point of regulation and investments. Equity may mean greater investment in disadvantaged communities and recycling revenue back to vulnerable populations. This could be in the form of a regular climate dividend, increasing the earned income tax credit, or direct investment in projects in or for the benefit of

⁴¹ https://lifo.vermont.gov/assets/Uploads/f7d068947e/DecarbonizationMethodsVT_Report_7.pdf

⁴² <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf>

disadvantaged communities. For example, investment in sustainable agricultural and forest programs could lead to greater carbon sequestration and support for these communities.

More jurisdictions covered lessens risks, increases impact and creates greater market stability

The more jurisdictions linked by the same system, the greater the reductions and the lower the chance a covered entity will relocate to a jurisdiction that does not regulate the targeted emissions.

When jurisdictions are linked, their allowance supply is jointly auctioned. The resulting price is expected to reflect the lowest cost of GHG abatement, regardless of which jurisdiction those reductions take place in. RGGI and WCI are examples of linked systems. Each jurisdiction adopts regulation and standards that emissions in one jurisdiction are calculated and accounted for in the same manner as in linked jurisdictions and that allowances issued in one jurisdiction hold the same value and therefore can be traded, purchased and used in any of the linked jurisdictions.

More sectors covered results in greater emissions reductions

The more sectors that are covered, the greater the emissions reductions and the revenue generated. A system that covers more of the emissions targeted for reduction will have a greater opportunity to meet its goals.

Annual reporting

The annual reports filled by California, Quebec and RGGI are valuable documents that provide transparency and insight into the system, its outputs and outcomes.⁴³

Mandatory reporting of emissions

This is the building block for a cap-and-invest system as it is the foundational element for determining the allowance obligation of each covered entity, determining the slope of the cap decrease and providing policymakers with insight into the scale and scope of the system. These data also make linkage with other programs easier as it enables jurisdictions to compare the size and scope of emissions between jurisdictions.

Timely reporting of emissions

Emissions reporting should be done in a timely manner to provide policymakers and administrative entities with the latest data to ensure program design reflects the most recent activity. This will not only ensure the fair and responsive allocation of allowances, it will reveal if polluters are clustering right below any threshold for becoming an obligated party, as well as providing insight into the decreasing cap trajectory.

Covered entities

Policymakers need to determine the sectors of the economy the system should include and the amount of emissions from a single source that would trigger a compliance requirement. Policymakers should set a minimum size for requiring coverage as the cost of regulating very small emitters may outweigh the

⁴³ <http://www.caclimateinvestments.ca.gov/annual-report/>
https://legislature.vermont.gov/assets/Legislative-Reports/RGGI_2018_Legislative_Report.pdf
https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf
http://www.environnement.gouv.qc.ca/ministere/rapports_annuels/rapportannuel2017-2018.pdf

benefit. Requiring reporting can help ensure that the limit below which participation is required doesn't become an opportunity for companies to fall just below that line. Reporting can reveal any such trend and policymakers can adjust the limit in response. The basic concept behind any cap-and-invest system is that those entities that emit pollution into the commons (air, water) should bear the price.

Those entities that would be covered by a cap should be engaged early on in the process of program design. Some of these entities already participate in voluntary carbon markets and/or include an internal cost of carbon in their accounting. They can provide helpful insights on ways to monitor and verify emissions.

Price on carbon

RGGI and WCI floor prices are both well below the social cost of carbon calculated by the federal interagency working group, currently set around \$40 per metric ton.⁴⁴ Establishing a floor price that reflects this value will put a more realistic value in the market.

System Design

Allowances

Removing or withholding allowances from the auctions through either the provision of free or consignment allowances reduces the vibrancy of the market. Allowing noncovered, nonobligated entities to purchase allowances brings in new capital but also presents a potential risk of speculation. Not allowing noncovered, nonobligated entities to purchase allowances can present liquidity risk. To mediate these two factors market administrators may consider placing limits on the amount of allowances that can be purchased and held by noncovered, nonobligated parties. Bids should have cash backing. There should be limits on the amount of allowances any one actor can hold to limit potential price manipulation. Most, or all, of the allowances should be auctioned.

Set a cap that meets policy objectives and decrease it periodically (e.g., annually)

The cap should be set low enough to have a meaningful impact and decrease at a rate necessary to meet the targets established. A declining cap also sends a signal to investors in R&D that they can more confidently invest. The cap should be set based on calculations using volumetric fuel data and fuel emission factors available from the Environmental Protection Agency.⁴⁵ This will also support future linking of the program with other jurisdictions that use the same methodology.

Regular review

The program and its measurable outcomes should be regularly reviewed. RGGI, California and Quebec establish compliance periods that present opportunities to refine and reconfigure the system. The same should be done on the investment side to ensure that the investments are providing the desired outcomes.

⁴⁴ This value is calculated by taking the present discounted value of the future damage caused by a 1 metric ton increase in carbon dioxide emissions into the atmosphere in that year.

⁴⁵ Drew Veysey, Gabe Pacyniak, and James Bradbury, *Reducing Transportation Emissions in the Northeast and Mid-Atlantic: Fuel System Considerations*, Georgetown Climate Center (July, 2018).

https://www.georgetownclimate.org/files/report/GCC_TransportationFuelSystemConsiderations_July2018.pdf.

Banked allowances – necessary constraints

Banked allowances should be limited in volume, have a phase-out component or be retired after a period. Without these constraints, entities could in the early years buy up allowances at lower cost and forego further emissions reductions in the out years, reducing the ability of the jurisdiction to meet its goals. The California Legislative Analyst Office finds that California could miss its 2030 target by as much as 30% due to unrestricted banking and unsold allowances.⁴⁶ Options include adjusting the cap downward correlated to the amount of banked allowances, building automatic cap adjustments into program design, introducing moderate limitations or voluntary phase outs to banking, having unused allowances expire at the end of the compliance period or annually, decreasing the value of banked allowances over time or some combination of all these. Decreasing the value of banked allowances would decrease the value of holding banked allowances.⁴⁷

Third-party verification

Third-party verification helps ensure market integrity and provides all parties with assurances that the system is fair and open. Third parties should be used to verify emission reporting, market systems and offset and investment results.

Point of regulation

Applying the obligation to the fewest number of parties by working up the supply chain will simplify the program and engage with entities who are accustomed to regulation. Piggybacking on existing reporting and enforcement mechanisms will also simplify the process. Engaging at the point where a tax is assessed for gasoline, diesel and home heating fuels is one option.

Price collar

Price collars provide greater price certainty, which supports long-term investments. The literature suggests that the price floor should be set at 50% below the expected allowance price in a given year, and the price ceiling should be set at 50% above the expected allowance price. The floor and ceiling should rise at a rate of about 5% per year plus inflation.⁴⁸

Price floor

Price floors provide stability and should be part of any program design. The price floor should also rise automatically at a set percentage. The literature suggests 5% plus the rate of inflation.

Entity established to administer program must be well supported and trusted

The entity that administers the program must have the trust and support of policy-makers and residents. Participants need to have faith that the market is fair and transparent and that the revenue is used to advance valuable projects that reduce carbon emissions and benefit residents and businesses.

⁴⁶ <https://lao.ca.gov/Publications/Report/3719>

⁴⁷ <https://energyinnovation.org/wp-content/uploads/2018/02/WCI-oversupply-grows-February-update.pdf>

⁴⁸ Designing Climate Solutions; A Policy Guide for Low-Carbon Energy. Harvey, Hal 2018, Island Press.

Unsold allowances should be permanently removed

Unsold allowances should be removed either immediately after the auction or at the end of each compliance period.

Offsets

Offsets should be limited to 20% of total obligations. Offset projects should have third-party verification paid for by a common pool of funds and selected by an independent entity. Protocols for these projects should be established and new protocols should be considered regularly.⁴⁹ The geographic location of offset projects should consider the opportunity to repair communities, people and environments damaged by emissions. For instance, in disadvantaged communities that have borne the brunt of pollution.

Monitoring and enforcement

Severe penalties for noncompliance and third-party verification of emissions reports help ensure compliance. Quebec, which has the most severe penalties, has 100% compliance by covered entities.

Automatic adjustments

To ease administrative burdens and remove short-term political considerations, adjustments in market mechanisms, such as cap decreases, floor and ceiling prices and cost containment levers, should be implemented with automatic triggers.

Confidential bids and financial guarantees

These prevent emission unit prices from skyrocketing and emission units from being hoarded by the most financially sound companies covered by the system or by participants with considerable financial resources.

What fuels to cover

Identifying the largest polluters for regulations should be coupled with considering the ease of administration and existing state and federal reporting requirements. Identifying existing points of engagement through regulation or taxation requirements provides the insight for which fuels can be covered for the greatest benefit at the lowest administrative and regulatory cost.

Investments

Sustainable long-term incentives and funding⁵⁰

Markets and businesses depend on predictable and consistent regulation and pricing. Developing programs that send those signals helps ensure more stable markets and invites greater participation by the private sector in developing innovative products to meet the market.

Research and development as part of the investment program

Dedicating a portion of investments to research and development, potentially targeted to the state's universities and colleges, helps grow the ecosystem that innovates and creates jobs in the climate

⁴⁹ Ibid.

⁵⁰https://www.transportationandclimate.org/system/files/TCI%20Listening%20Session%20Summary%20Report_11-14-2018.pdf

economy. Policymakers should determine the appropriate percentage of funds that should be invested in R&D and the eligible entities to receive those funds, including whether a portion should be dedicated to public private partnerships (P3).

Funds should be held separate from general funds

To the extent possible funds should be segregated from the general budget of the state to minimize the possibility that they are used for activities not linked to GHG reduction. Statutorily requiring that these funds be spent on specific areas of activities that provide Vermonters and Vermont businesses with low-to no-carbon options to heat their homes and businesses and meet their transportation needs also can increase support for the system. Quebec has established an independent entity to manage their funds.

Revenue only used for decarbonization activities

A clear statement of intent that these funds are only to be used for activities that support Vermonters and Vermont businesses with options to reduce their emissions helps show the nexus between revenue raised and used.

Shovel-ready projects

Having shovel-ready projects was a lesson learned in Quebec where the revenue received from the cap-and-invest program was not able to be immediately deployed because a pipeline of projects and programs ready to take advantage of the funds did not exist.

Climate dividend visible to consumers

California's utility rebate is a visible way of showing residents and businesses that the system is providing them with direct value.

Rebates can't be tied to emissions

Any rebates provided to residents or businesses should not be tied to the amount of emissions they produce. If the rebates are linked to emissions, it could disincentivize emissions reductions. Having rebates either flat or linked to economic output can incentivize innovation and efficiency.

Delay between costs and benefits

A time delay exists between when investments are made and when the benefits are realized. For instance, in the case of acquiring an electric vehicle, the benefits accrue over several years. The same is the case for acquiring a cold climate heat pump or advanced wood heat system. One way to address this delay is to earmark a portion of funds to protect vulnerable populations, businesses and key industries during the "negative window" of the program.⁵¹ This same concern applies to the provision of incentives or rebates for consumers. Point-of-sale incentives can assist in eliminating the delay between the outlay of funds and receipt of incentives. This delay has a dampening effect and is a greater barrier to lower-income participants.

⁵¹ <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf> (p. 10)

Conclusion

Cap-and-invest systems to reduce GHG emissions have shown much promise. The investments from the proceeds of the auctions in the three jurisdictions reviewed have been used to grow the economy, protect the most vulnerable, provide more affordable ways to heat and cool homes and meet people's needs to travel to work, school, shopping and social activities.

The triple win of such a system – reduced emissions, increased economic output and investments in programs that equitably accelerate the transition to a clean energy economy – are what make cap-and-invest systems appealing.

Designing a cap-and-invest system for maximum effect is a job for policymakers and other key stakeholders. They should consider the experiences and lessons reviewed in this paper as a framework for their deliberations.

- The point of regulation should be as high up the supply chain as possible.
- The more jurisdictions that are covered by a system and the more sectors that are included, the deeper the impact and the lower the chance of obligated parties moving to a jurisdiction outside the system.
- The cap should decrease at a rate that meets necessary goals. Market adjustments should be automated for speed, consistency and administrative ease.
- The program should ensure long-term investments to provide markets and businesses with the predictability that can drive innovation.
- Investments should primarily be made in decarbonizing activities, and as much as possible, the revenue should be walled off from general or transportation fund revenue. However, investing in public transit, pedestrian and bicycle facilities could reduce the pressure on the transportation fund from reduced gas tax collection.
- Investing proceeds in research and development can have a multiplier effect on the economy.
- Investments should be directed to low- and moderate-income Vermonters and disadvantaged communities to help facilitate a just transition to a clean energy economy. These investments should include economic development opportunities and job training, as well as greater incentives for efficient and low- to no-carbon heating and transportation options.
- The program should be structured so that it can be linked with existing programs, which could include expanding RGGI to include transportation and heating emissions, linking with WCI or any new program designed through the TCI process.
- The entity(ies) administering the program should be trusted and transparent in their dealings.
- The program should have regular reviews. Third-party verification should be a core principal.
- Requiring legislative action to withdraw from an established system.

A successful cap-and-invest program will not last indefinitely. A successful program will achieve its emission reductions and phase out. The goal of this effort is to adopt cost effective low- to no-emitting practices in time to help avoid the worst impacts of the climate crisis. The sooner we begin this work, the sooner the benefits can be realized.

Case Study - Regional Greenhouse Gas Initiative (RGGI)

History

Beginning in 2003, Vermont Governor James Douglas engaged in deliberations with fellow governors from Connecticut, Delaware, Maine, Massachusetts, New Hampshire, New Jersey, New York and Rhode Island to establish a regional cap-and-trade system to reduce CO₂ emissions from power plants.

In 2005, Vermont joined these states in signing a memorandum of understanding agreeing to establish and implement the Regional Greenhouse Gas Initiative (RGGI). States then created a model rule that provided the framework for each state's regulatory and/or statutory proposals.

In 2005 Vermont adopted 30 VSA Section 255 and promulgated rules⁵² establishing a CO₂ budget trading program to comply with the RGGI framework.

RGGI is an entity that is created by and for the participating states. Consequently, states can withdraw from RGGI, as New Jersey did in 2012. There was no discernable impact to RGGI of New Jersey's exit. There was however an estimated loss of \$500 million in revenue to New Jersey from 2012-20. States can also petition to join RGGI after adopting the model rule, as New Jersey and Virginia are currently doing (April 2019).

The first precompliance RGGI auction took place in September 2008, and the program became effective on January 1, 2009. After a comprehensive review in 2012 and again in 2017,⁵³ the program was strengthened by reducing the cap. RGGI is currently in its fourth three-year compliance period, which began January 1, 2018.

Key features of RGGI

- RGGI states account for 1/8 of the U.S. population and 1/7 of the nation's GDP. Electricity is derived from fossil fuels in most of the nine states (Vermont is an exception).
- **Cap:** RGGI sets an annual cap for the region's CO₂ emissions, applied to all fossil fuel-fired electric generators with a capacity of 25 megawatts or higher. The cap declines 2.5% per year from 2015-20. Pollution allowances (equivalent to 1 ton of CO₂) are auctioned quarterly.
- **Auctions:** Auctions are administered quarterly by RGGI, Inc., a nonprofit established as the implementation entity. Participating power plant owners submit confidential bids, which then inform the price of allowances for that auction. Participants are permitted to trade or purchase allowances in a secondary market.
- **Compliance:** RGGI is set up in three-year compliance periods. At the end of each period, covered entities must submit one allowance for each ton of CO₂ generated during the three-year period.
- **Banking Allowances/Offsets:** Participants may bank allowances for future use and may meet up to 3.3% of their compliance obligation through the purchase of offsets.

⁵² https://dec.vermont.gov/sites/dec/files/aqc/laws-regs/documents/Vermont_CO2_Budget_Trading_Program_Rule_adopted_08292018.pdf

⁵³ https://www.rggi.org/sites/default/files/Uploads/Program-Review/12-19-2017/Summary_Model_Rule_Updates.pdf

- **Revenues:** Proceeds generated from the auction are disbursed to states in accordance with RGGI’s state budget allocation. While they may be used to fund various state policy objectives, at least 25% of proceeds must be used for “consumer benefit or strategic energy purpose.”
- **Investments:** In 2016, 94% of proceeds were used for efficiency, GHG abatement, renewable energy or electricity bill assistance. Proceeds also can be used to meet other state objectives such as job training. It is up to each participating jurisdiction how they want to use them. VT spells this out in 30 VSA Section 255. Vermont received \$19.9 million in proceeds from 2008-16. RGGI investments represent \$2.6 million in 2016, and \$18.6 million cumulatively since 2005. \$1.2 million is committed to 2017 and future programs.⁵⁴

For 2019, RGGI sets a cap of 80.2 million tons of CO₂. Vermont has been allocated 577,390 tons in its base budget, representing less than 1% of the RGGI allowances.⁵⁵ Allowances are based on the cap and where fossil fuel generating units are located. Vermont has two fossil-fuel electric generating units,⁵⁶ both of which are used only during peak need and thus have low overall emissions.

RGGI 2019 CO₂ Allowance Budgets by State

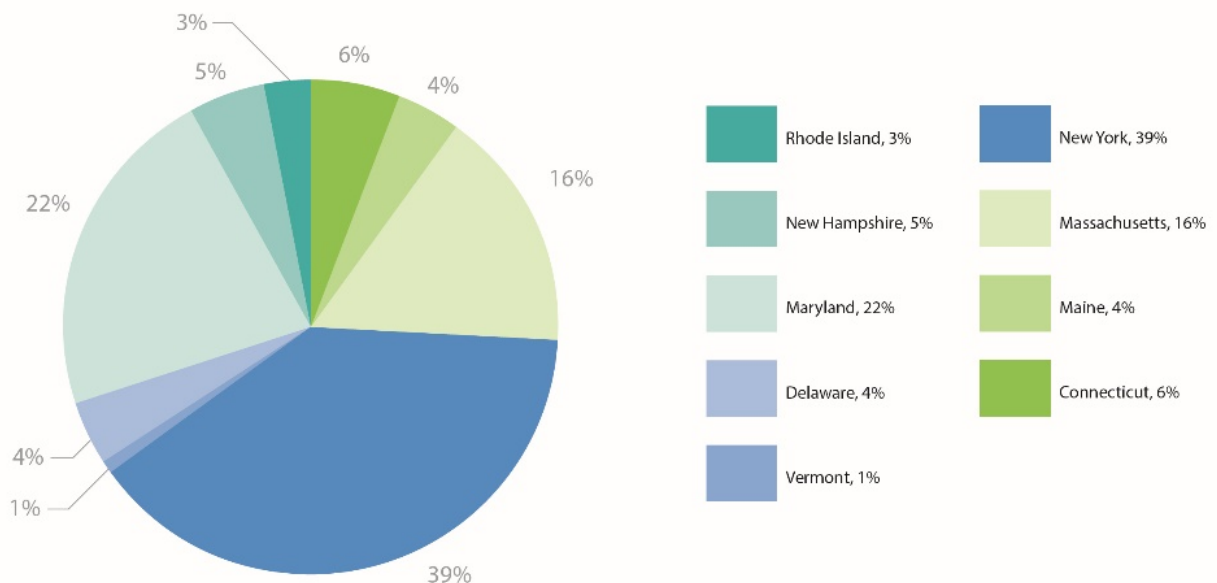


Figure 8 - RGGI 2019 CO₂ allowance budgets by state⁴⁹

⁵⁴ https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf

⁵⁵ https://www.rggi.org/sites/default/files/Uploads/Allowance-Tracking/2019_Allowance-Distribution.pdf

⁵⁶ Penny Lane, Burlington gas turbine, and Berlin, VT: <https://rggi-coats.org/eats/rggi/Docs/2018InterimComplianceSummaryReport.pdf>

Emissions Reduction and Economic Results

Since its first auction in 2008 RGGI auctions have generated more than \$2.6 billion of revenue.⁵⁷ As shown in Figure 9, CO₂ emissions from electricity generating facilities dropped by nearly 40% from 2009-17, while RGGI state economies grew by 21.2% compared to the national average of 18.2%.⁵⁸

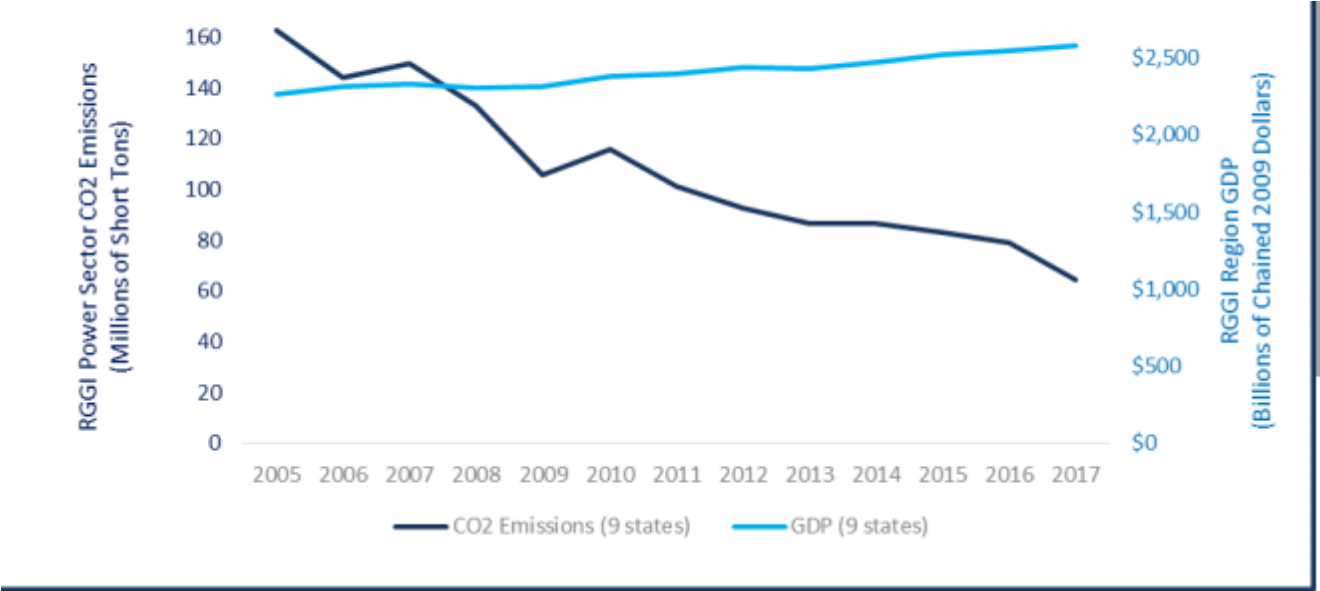


Figure 9 - RGGI power sector pollution reductions

RGGI results show that as part of a suite of emissions reduction policies, including renewable portfolio standards (RPS), a cap-and-invest system can catalyze and amplify investment in emissions reduction measures. The results to date show that RGGI has been a successful example of a cap-and-invest system that can reduce emissions, drive investments and increase economic well-being.

According to a report by Abt Associates, *Analysis of Public Health Impacts of RGGI, 2009-2014*, RGGI also produced \$5.7 billion in public health benefits. These benefits included avoided incidences of asthma emergency room visits, nonfatal heart attacks, acute bronchitis and infant mortality.⁵⁹

⁵⁷ https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf (accessed February 2019)
⁵⁸ https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf
⁵⁹ <https://www.abtassociates.com/rggi>

Investment

From 2005 to 2016, RGGI states invested \$2.17 billion of their \$2.6 billion cap-and-invest proceeds in a variety of programs aimed at further reducing emissions and benefiting low- and moderate-income households, as shown in Figure 10. The majority of RGGI proceeds have been spent on energy efficiency (55%) with 11% directly benefiting low-income residents.

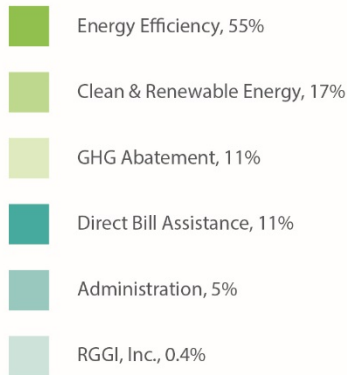
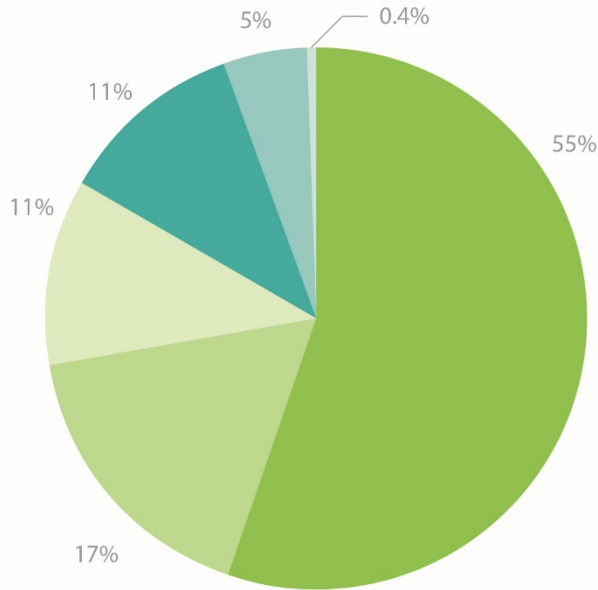
The proceeds from the RGGI auctions have enabled states to prioritize investments to meet policy objectives. There is a clear nexus to the source of revenue in most of these investments,⁶⁰ including energy efficiency, clean energy, clean transportation and direct electric utility bill assistance.

RGGI requires that at least 25% of the auction proceeds allocated to each state go to consumer benefit or strategic energy purpose.⁶¹ This broad nature of consumer benefit has allowed states to use the proceeds for activities that do not lead to decarbonization.

⁶⁰\$93.1 million was transferred to state general funds by acts of state legislature.

⁶¹ https://www.rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2017-Program-Review-Update/2017_Model_Rule_revised.pdf

2016 RGGI Investments by Category



2016 RGGI Investments by Recipient

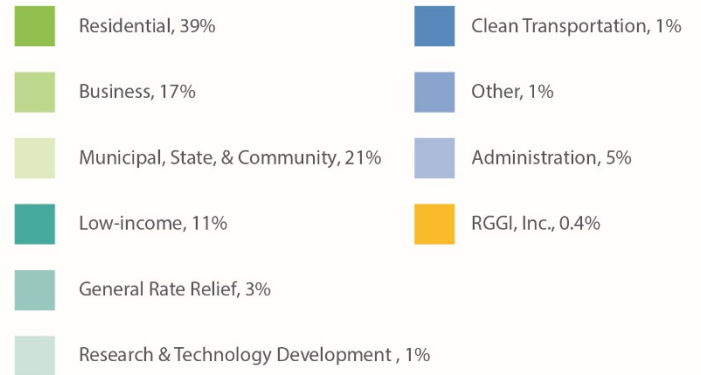
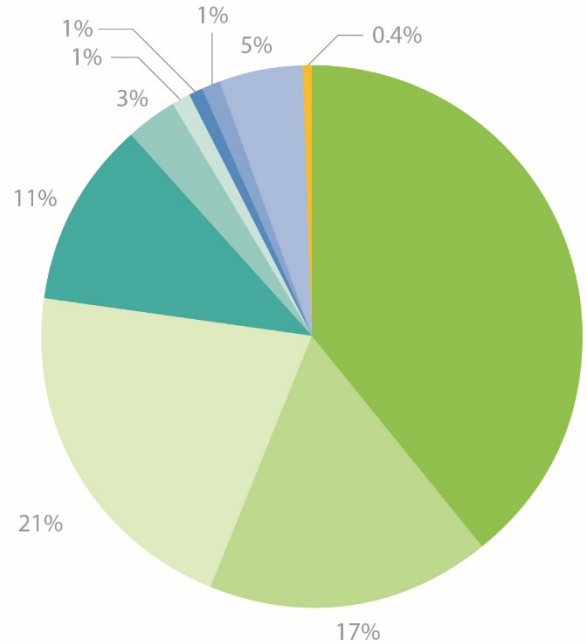


Figure 10 - 2016 RGGI investments by category and recipient⁶²

Through 2016, Vermont RGGI auction proceeds have supported Vermont's Home Performance with ENERGY STAR® service for residential customers, the building performance energy efficiency service for small business customers and low-income energy efficiency services through 3E Thermal project management. Over 100,000 tons of CO₂ and more than \$155 million of savings are expected to be

⁶² https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf

realized over the lifetime of those investments. Vermont's RGGI-funded programs have served approximately 8,700 households and 500 businesses.⁶³

Governance

RGGI, Inc., is managed by a board of directors that consists of two directors from each participating state.⁶⁴ A participating state is one that has adopted the model rule⁶⁵ (establishing the regulatory and statutory framework for a state to initiate a program) and has established a contract with RGGI, Inc. RGGI, Inc. has no regulatory or enforcement authority. All such sovereign authority is reserved by the individual state.⁶⁶

RGGI, Inc.'s exclusive purpose is to provide administrative and technical services to support the development and implementation of each RGGI state's CO₂ budget trading program, including the following components.

- Develop and maintain a system to report data from emissions sources subject to RGGI and track CO₂ allowances
- Implement a platform to auction CO₂ allowances
- Monitor the market related to the auction and trading of CO₂ allowances
- Provide technical assistance to the participating states in reviewing applications for emissions offset projects
- Provide technical assistance to the participating states to evaluate proposed changes to the states' RGGI programs

A complete list of market components is contained in Appendix 2.

Lessons Learned

The 2012 program review highlighted challenges RGGI was experiencing.⁶⁷ Most of these related to the price of allowances and the ability to effectively meet the cap. The review led to changes in the model rule that included the following.

- Lowering the regional cap
- Establishing a cost containment reserve (CCR) and its price triggers
- Setting limits to the use of banked allowances

⁶³ https://www.rggi.org/sites/default/files/Uploads/Proceeds/RGGI_Proceeds_Report_2016.pdf (p. 39)

⁶⁴ https://www.rggi.org/sites/default/files/Uploads/RGGI-Inc-Documents/RGGI_bylaws_2019.pdf

⁶⁵ https://www.rggi.org/sites/default/files/Uploads/Design-Archive/Model-Rule/2017-Program-Review-Update/2017_Model_Rule_revised.pdf

⁶⁶ <https://www.rggi.org/rggi-inc/contact>

⁶⁷ https://www.rggi.org/sites/default/files/Uploads/Design-Archive/2012-Review/2013-02-11/Recommendations_Summary.pdf

These components were strengthened by two additional changes in the 2017 program review.⁶⁸

- Creation of an emissions containment reserve (ECR) and trigger prices
- Updates to offset categories

It is useful to note that the challenges RGGI addressed in these program reviews related to market stability, allowance prices and strength of the cap.

The structure of RGGI allows states to join or withdraw. A program should have clear processes for joining and withdrawing that minimize market disruption.

⁶⁸ https://www.rggi.org/sites/default/files/Uploads/Program-Review/12-19-2017/Summary_Model_Rule_Updates.pdf

Case Study - California

History

In 1988, California passed legislation directing the California Energy Commission to prepare and maintain an inventory of GHG emissions, as well as study and make recommendations about climate change and its associated impacts. Establishing this inventory provided the data required to determine an emissions cap, understand which sectors the emissions were coming from and set the reasonable size of emissions that would place an entity under the cap and have it become a covered entity.

In 2006, Assembly Bill (AB) 32, also known as the California Global Warming Solutions Act, was passed. It required the California Air Resources Board (CARB) to reduce GHG emissions to 1990 levels by 2020 in a cost-effective and technologically feasible way. To identify and meet these goals, a scoping plan was created to outline strategic steps. The scoping plan identified cap-and-invest⁶⁹ as one of the strategies for meeting the GHG reduction goals of AB 32. CARB designed the cap-and-invest program with the intention of it being enforceable to meet AB 32 requirements, while considering potential impacts to low-income communities.

In 2007, California joined with five other jurisdictions in creating the Western Climate Initiative (WCI) with the goal of collaborating to identify, evaluate and implement GHG emissions reduction strategies. The states committed to develop a regional market-based multisector cap-and-invest program.⁷⁰

In 2011, WCI, Inc. was created to provide administrative and technical support to state and provincial GHG emissions trading programs. California held its first auction for GHG emissions from the electricity sector in 2012 and for transportation and heating fuels in 2014.

The 2012 budget bill, Senate Bill 1018 established the Greenhouse Gas Reduction Fund (GGRF). The GGRF was established as the account to receive cap-and-invest auction proceeds.

In 2016, SB 32 required CARB to reduce GHG emissions to 40% below the 1990 level by 2030, thus extending the 2020 time-frame set in AB 32 and sending the market signal that the program would continue beyond 2020.

The passage of AB 398 in 2017 reauthorized the state's cap-and-invest program from January 1, 2020, through December 31, 2030, providing additional market surety that the program would continue. AB 398 also established the following additional investment priorities for cap-and-invest auction proceeds.

- Air toxics and criteria air pollutants from stationary and mobile sources
- Low- and zero-carbon transportation alternatives

⁶⁹ California refers to its program as cap-and-trade. In this report, all programs that have an investment component to their structure are classified as cap-and-invest to differentiate them from programs that only cap and trade and contain no investment provisions.

⁷⁰ <http://www.westernclimateinitiative.org/document-archives/general/WCI-Governors-Agreement>

- Sustainable agricultural practices that promote transition to clean technology
- Water efficiency
- Improved air quality
- Healthy forest and urban greening
- Short-lived climate pollutants
- Climate adaptation and resiliency
- Climate and clean energy research

As a companion bill to AB 398, AB 617 was enacted to address the nexus between climate change and community-level air pollution, particularly in low-income communities and communities of color most impacted by criteria air pollutants and toxic air contaminants. AB 617 established the Community Air Protection Program, which includes air quality monitoring and local emissions reduction and mitigation plans. This program also receives funds from the state's auction proceeds.

Emissions Reductions and Economic Results

California has seen dramatic economic growth during the years that the program has been in place. From 2013- 2016, California added 1,334,625 jobs, which represents 7.9% growth, outpacing 6.2% job growth in the rest of the U.S. in the same period. Of these, 136,664 were advanced energy jobs, which represents 33.2% growth, more than quadruple the state's total job growth rate in the same period.⁷¹ As shown in Figure 11, since program launch in 2012, GHG emissions in California have declined by 8% through 2016 and gross state product has increased by 26% through 2017.

⁷¹ <https://www.edf.org/sites/default/files/cutting-carbon-growing-economy.pdf>

California has decoupled emissions and economic growth (2000-2017)

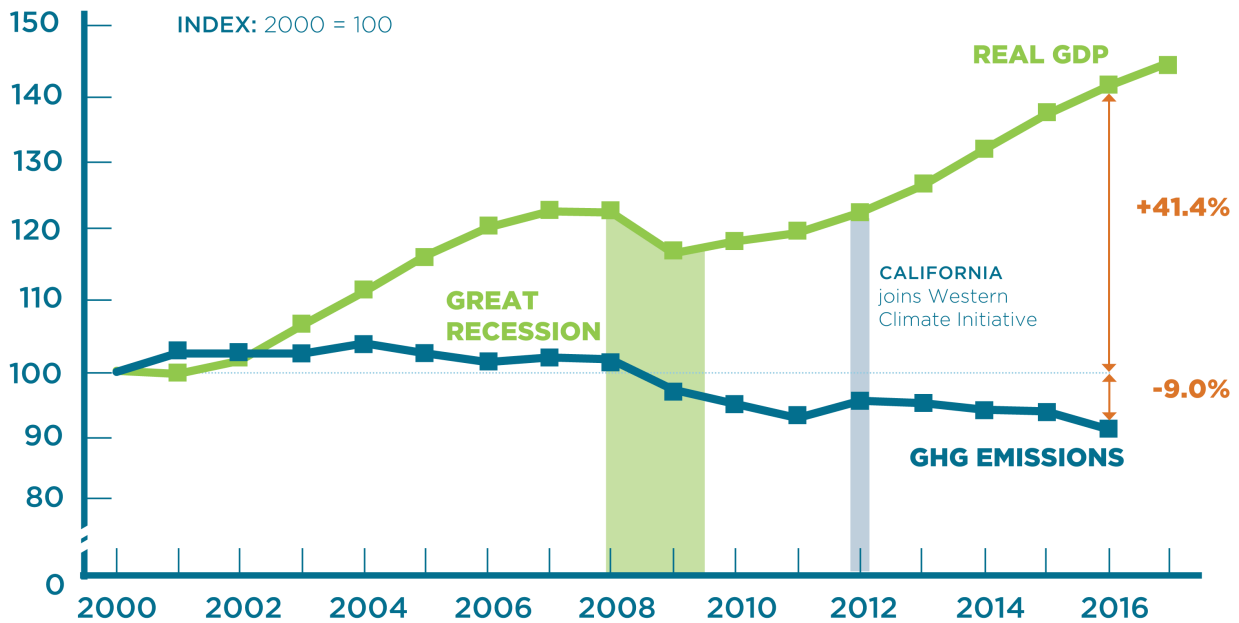


Figure 11 - California GHG and GDP (EAN)

California investments funded by auction proceeds were responsible for almost 700,000 metric tons of *annual* CO₂ reductions through 2016, which is about 3% of all observed CO₂ reductions in California since 2012.⁷²

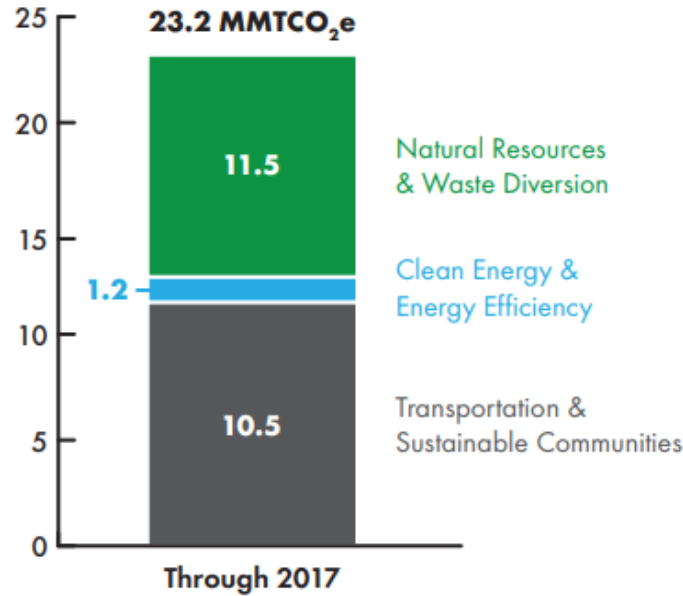
Committed funds will produce nearly 1.2 million metric tons of CO₂ reductions annually through 2026. This represents the ongoing reductions that long-term measures provide. For instance, a zero-emission vehicle will continue to reduce emissions each year its used. In fact, with a zero-emission vehicle, the emissions reductions increase as the grid gets cleaner. These investments will help California reach approximately 7% of its GHG reduction goal between 2020-30.⁷³

The cumulative impact of the programs and projects funded by the state's climate investments have resulted in 23.2 MMTCO₂e reduction since inception as shown in Figure 12.

⁷² <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf>

⁷³ Ibid.

GHG Emission Reductions from Implemented Projects*



Estimated GHG Benefits Over Project-specific Quantification Period

* Estimates for projects implemented do not include benefits from the High-Speed Rail Project.

Figure 12 - Estimated GHG benefits and cumulative implemented projects⁷⁴

Investment

California auction proceeds have generated \$9.3 billion⁷⁵ from 2013-18. Through fiscal year 2017-18, the state legislature appropriated \$6.1 billion to 19 administering agencies to “design and implement a suite of programs in transportation and sustainable communities, clean energy and energy efficiency, and natural resources and waste diversion.”⁷⁶ In 2017 WCI, Inc. expenses were less than \$5 million or 0.08% of CA revenue raised.⁷⁷

⁷⁴ https://arb.ca.gov/cc/capandtrade/auctionproceeds/cci_annual_report_2017.pdf

⁷⁵ <http://www.ebudget.ca.gov/2019-20/pdf/BudgetSummary/FullBudgetSummary.pdf> (p. 123)

⁷⁶ https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2018_cci_annual_report.pdf

⁷⁷ http://www.wci-inc.org/docs/Audited_Financial%20Statements_Approved_English.pdf

As shown in Figure 13, California invests 45% of the allowance revenue, provides 35% to electric and gas utilities that are required to pass along revenue to residential customers, about 15% in the form of free allowances to energy-intensive, trade-exposed industries and small businesses and reserves 5% for price containment releases.⁷⁸

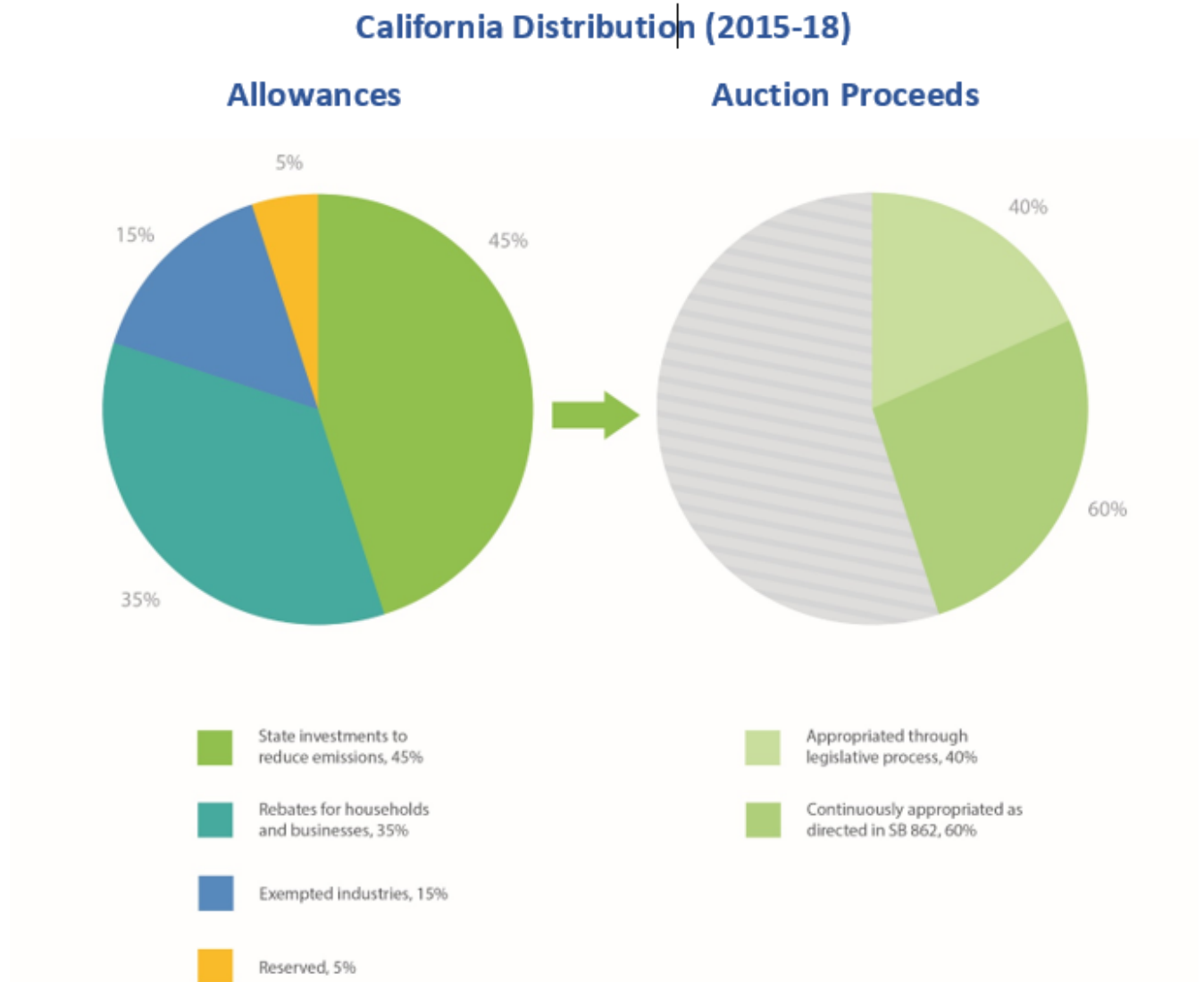


Figure 13 - California's distribution of allowances and auction proceeds 2015-18⁷⁹

Funded programs and projects are collectively referred to as California Climate Investments. Auction proceeds are deposited in the GGRF. Of the 45% that the state invests in emissions reductions programs, 40% is appropriated through the annual process shown in Figure 14.

⁷⁸ <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf>

⁷⁹ <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf>

Making California Climate Investments

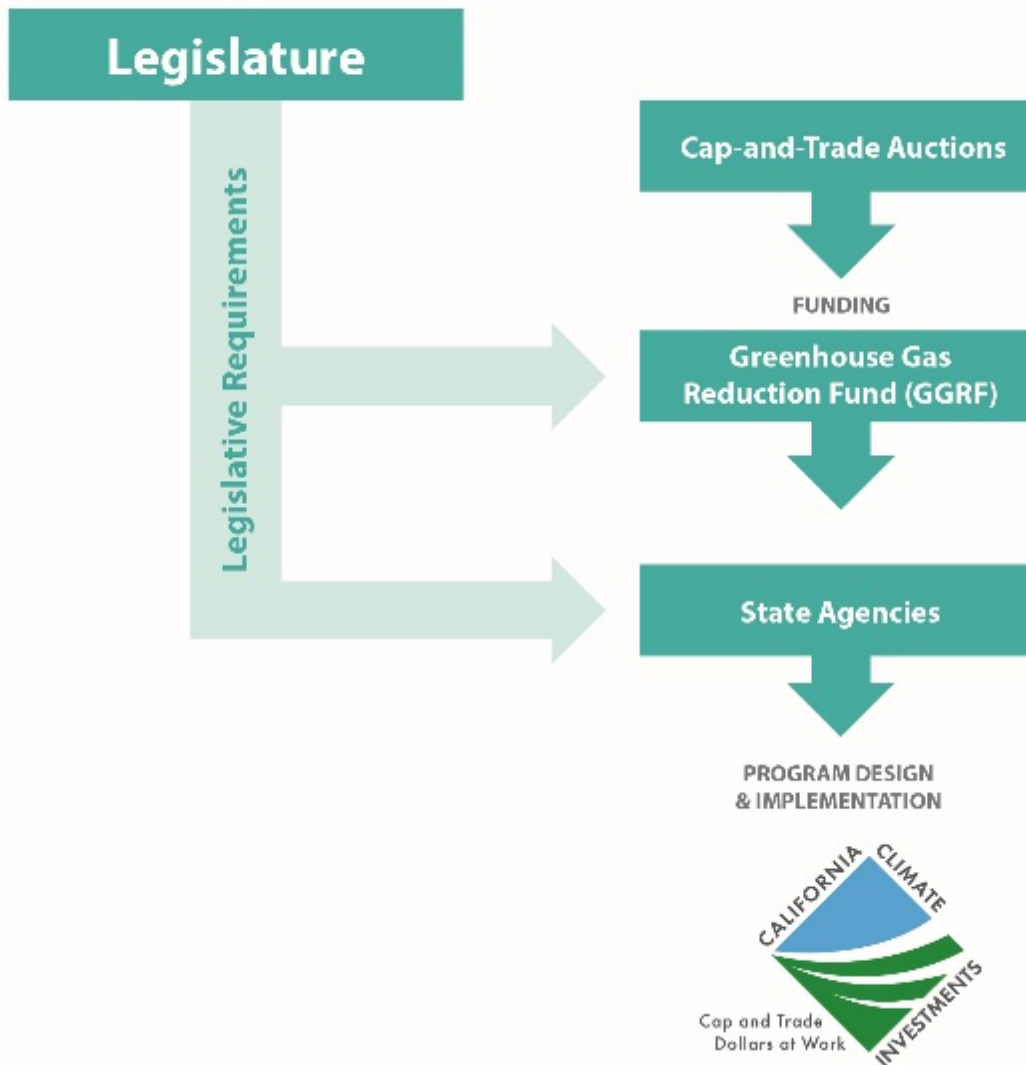


Figure 14 - California Climate Investment flow of funds⁸⁰

SB 862 (2014) establishes continuous annual appropriations for 60% of the auction proceeds to the following programs.

- Low Carbon Transit Operations Program
- High-Speed Rail Project

⁸⁰ https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2018_cci_annual_report.pdf

- Transit and Intercity Rail Capital Program
- Affordable Housing and Sustainable Communities

The California Department of Finance, in consultation with CARB and other state agencies, develops and submits a three-year investment plan for cap-and-trade auction proceeds to the legislature. The plan serves several purposes.

- Identifies opportunities for GHG emission reductions
- Identifies potential investment priorities to help the state achieve its climate targets
- Benefits priority populations (disadvantaged communities, low-income communities and low-income households – see more below)
- Yields valuable co-benefits, e.g., economic and public health benefits

Equity

In 2012, the legislature established investment minimums for California Climate Investments to benefit disadvantaged communities. In 2016, it expanded those considerations for low-income communities and low-income households.

SB 535 (2012) requires the following.

- The California Environmental Protection Agency to identify disadvantaged communities for California Climate Investments
- The development of funding guidelines for administering agencies that show these agencies how to maximize benefits to the identified disadvantaged communities
- A minimum of 25% of the GGRF monies⁸¹ to be allocated for projects that provide benefits to disadvantaged communities
- A minimum of 10% of GGRF monies to be allocated for projects located within disadvantaged communities⁸²

AB 1550 (2016) increased the minimum investment for projects located within, and benefitting individuals living in, disadvantaged communities from 10% to 25%. AB 1550 also defined low-income communities and low-income households and required that at least 10% of GGRF monies to be invested in these two categories.

- A minimum of 5% to projects that benefit low-income households or to projects located within low-income communities located anywhere in the state⁸³

⁸¹ GGRF funds represent the proceeds from the 45% of allowances that are placed in auction.

⁸² http://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201120120SB535

⁸³ Disadvantaged communities are identified by the California Environmental Protection Agency (CalEPA) as the top 25% most impacted census tracts in CalEnviroScreen 3.0. Low-income communities and households are defined as the census tracts and households, respectively, that are either at or below

- A minimum of 5% to projects that benefit low-income households and low-income communities that are outside of, but within a half mile, of a disadvantaged community

In keeping with AB 1550 and other statutory requirements, CARB identifies program-level investment minimums to benefit disadvantaged communities and low-income residents in programs funded by California Climate Investments.⁸⁴

Programs with statutory minimum investments levels are.⁸⁵

- Affordable Housing and Sustainable Communities Program. Minimum 50% in disadvantaged communities
- Low Carbon Transit Operations Program. If there are disadvantaged communities in the operator's service areas, a minimum 50% must benefit disadvantaged communities
- Transformative Climate Communities. Supports coordinated project investment in disadvantaged communities, current focus on top 5% disadvantaged communities
- Transit and Intercity Rail Capital Program. Minimum of 25% to disadvantaged communities
- Urban Greening Grant Program. Minimum 75% in and for disadvantaged communities and low-income communities

Governance

CARB oversees California's cap-and-invest market.⁸⁶ WCI, Inc., which administers California's program, is chaired by the chair of CARB. California's other representatives on WCI, Inc. are the California Secretary for Environmental Protection and the California Environmental Protection Agency (CalEPA).

The California Department of Finance, CalEPA and CARB provide an overarching administrative framework for agencies administering California Climate Investments. Together, Finance, CalEPA and CARB are responsible for developing tools, plans, guidelines, methodologies, reports and other resources. GGRF is the name of the designated account that receives and accounts for the proceeds from auctions.

Guidance documents and tools are updated periodically to reflect new legislation, updated information and stakeholder feedback.

80% of the statewide median income or at or below the threshold designated as low income by the California Department of Housing and Community Development's (HCD's) 2016 State Income Limits.

⁸⁴https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/priority_targets_fy1819.pdf?_ga=2.215649623.1965504716.1550441335-205080698.1548357006

⁸⁵ SB 859 (Committee on Budget and Fiscal Review, Chapter 368, Statutes of 2016)

⁸⁶ CARB consists of 16 members; 12 are appointed by the governor and confirmed by the state senate. The other four include two who represent environmental justice communities (one appointed by the senate and the other by the assembly) and two nonvoting members appointed for legislative oversight, one each from the senate and assembly. The 12 gubernatorially appointed members include five who serve on local air districts, four experts in fields that shape air quality rules, two public members and one, the chair, who serves as the only full-time member. The governor can choose any of the board members to serve as the chair.

A complete list of market components can be found in Appendix 2.

Lessons Learned

There are three main areas where California's program evolved. First, it grew to cover 85% of GHG emissions, ensuring that the state was on a path to meet its GHG reduction goals. Second, it extended its life beyond 2020 to 2030, sending strong market signals. Third, it adopted strong equity requirements (described above).

California also is addressing the early banking of allowances. California has not adjusted allowance budgets like RGGI.

California adopted several changes to their program in 2018 to take effect in 2021.⁸⁷

- Establishing a price ceiling of \$65. No price ceiling exists currently.
- Revising offset limits to 4% of a covered entity's compliance obligation (2021-25) and 6% 2026-30. Offsets are currently limited to 3% of an entity's compliance obligation.
- Addressing leakage assistance and updates to allowance allocations.

California has found that cap-and-invest systems have leveraged substantial private sector revenue by sending clear market signals that the investments are supported by long-term governmental policy. California's \$2 billion climate investment has led to \$8.2 billion of private capital.⁸⁸ That is, for every \$1 of investments \$4.10 of private capital has been deployed to support these initiatives. The price signal and support provided by cap-and-invest has catalyzed private sector response and accelerated investments.⁸⁹

California also has found that while secondary markets help mobilize capital and price discovery, there can be challenges with an unregulated secondary market. For instance, over-the-counter trades do not lead to price discovery as the trade occurs "off the books." The short-term nature of future contracts in existing cap-and-invest systems, closer to three days, are transactionally expensive. Regulated utilities are not permitted to purchase these instruments as they are considered speculative.

⁸⁷ https://www.arb.ca.gov/regact/2018/capandtrade18/ct18uid.pdf?_ga=2.102673220.412614358.1551630731-205080698.1548357006

⁸⁸ <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf> (p. 21)

⁸⁹ https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/2018_cci_annual_report.pdf (Case study 2)

Case Study - Quebec

History

Throughout the early 1990s and 2000s, Quebec made critical steps to lay the foundation for today’s cap-and-invest system. Quebec established a GHG inventory system in 1990 and ratified the United Nations Framework Convention on Climate Change in 1992.

Quebec established a Climate Change Action Plan in 2006, including a carbon fee on fossil fuels used for transportation, and the first stage of the plan (2006-12) succeeded in reducing GHG emissions by 8% compared to 1990 levels, surpassing their 6% target. Establishing a cap-and-invest system, linked with California and holding joint auctions through WCI, Inc., is a key component of the second phase (2013-20) of the Climate Change Action Plan.

Quebec’s Green Fund (CGFV) was established in 2006⁹⁰ with a major overhaul in governance structure in 2017. Like the California model, the Green Fund is a separate account that provides funding for departments and agencies to carry out GHG reduction programs. Unlike the GGRF in California, the CGFV has administrative and programmatic responsibilities (see Figure 15). As shown in Figure 16, the Green Fund receives the proceeds from the carbon market and appropriates them to activities.

Green Fund Management Board

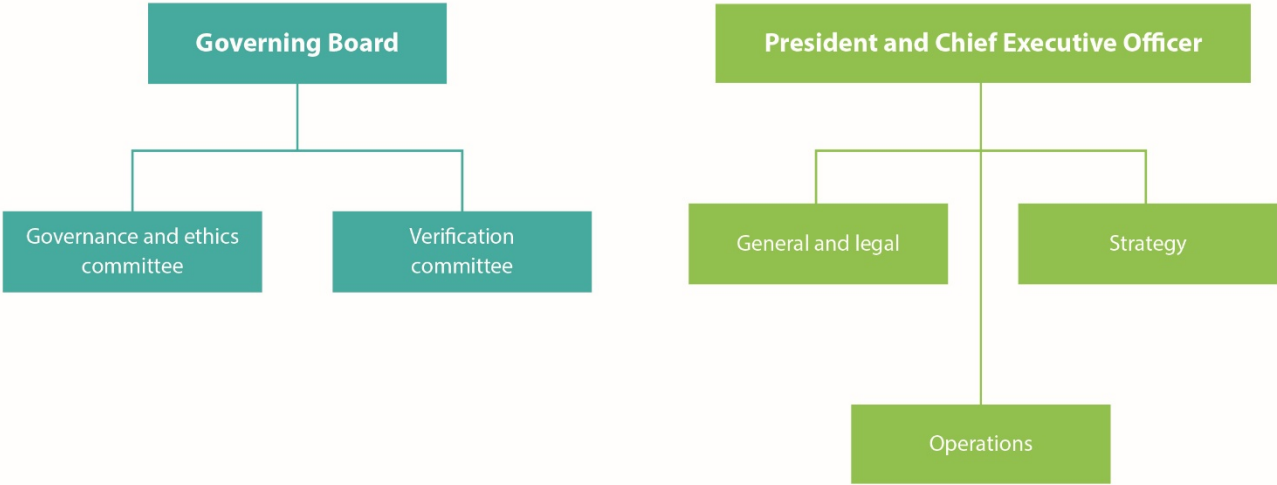


Figure 15 - Green Fund management

⁹⁰<http://legisquebec.gouv.qc.ca/en/showdoc/cs/M-30.001> Section 15.1

Green Fund Revenue and Investments

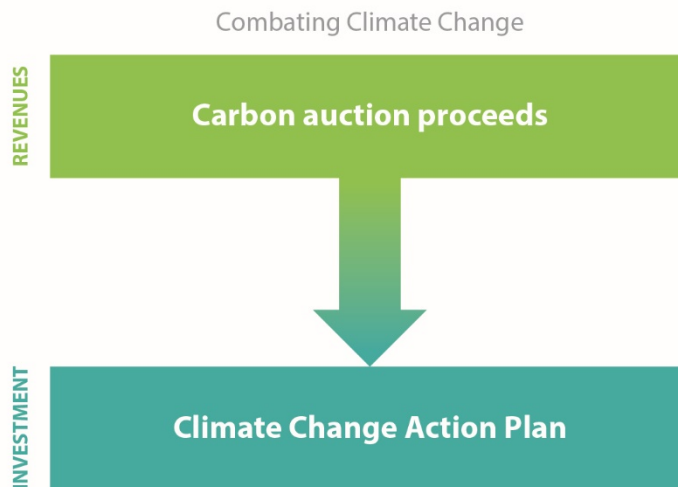


Figure 16 - Green Fund revenue and investments

The CGFV develops agreements with departments and agencies to allow them access to the fund to implement programs and projects as detailed in the Action Plan on Climate Change (2013-20). In 2012, Quebec also developed its first Climate Change Adaptation Strategy (2013-20). The action plan helps achieve the objectives outlined in the Adaptation Strategy.

Quebec's cap-and-invest system formally began in January 2013 as the primary tool to accelerate its GHG emission reduction targets below 1990 levels.

- 20% reduction by 2020
- 37.5% by 2030
- 80-95% by 2050⁹¹

In 2014, Quebec linked its market to California's and expanded the reach from just the electricity sector to additionally cover transportation, heat and industry. This created the largest carbon market in North America and the first one designed by and for subnational jurisdictions in different nations.

All proceeds from the cap-and-invest auction are deposited in the CGFV to invest in the transformation of the energy sector and the economy overall, with an emphasis on reaching low- and middle-income

⁹¹ Quebec's regulation can be found at: <http://legisquebec.gouv.qc.ca/en/pdf/cr/Q-2,%20R.%2046.1.pdf>

citizens. These projects, which implement the 2013-2020 Climate Change Action Plan, have accomplished the following.

- Reduced GHG emissions
- Enabled Quebec citizens to deal with the impacts of climate change
- Invested in research and development that will lead to long-term GHG reductions
- Taken actions to better protect the natural and built environment to reduce the vulnerability of our children and future generations to the impacts of climate change

Emissions Reductions and Economic Results

Quebec's cap-and-invest program has generated \$2.8 billion (CAD) and has created 45,000 clean-tech jobs. The second compliance period posted a 100% compliance rate by obligated parties.⁹² Since 2012, Quebec has seen a 7% reduction in GHG emissions from manufacturing, 6.4% reduction from petroleum refining and 8.8% reduction from large facilities.⁹³

Quebec has decoupled emissions and economic growth (2000-2017)²

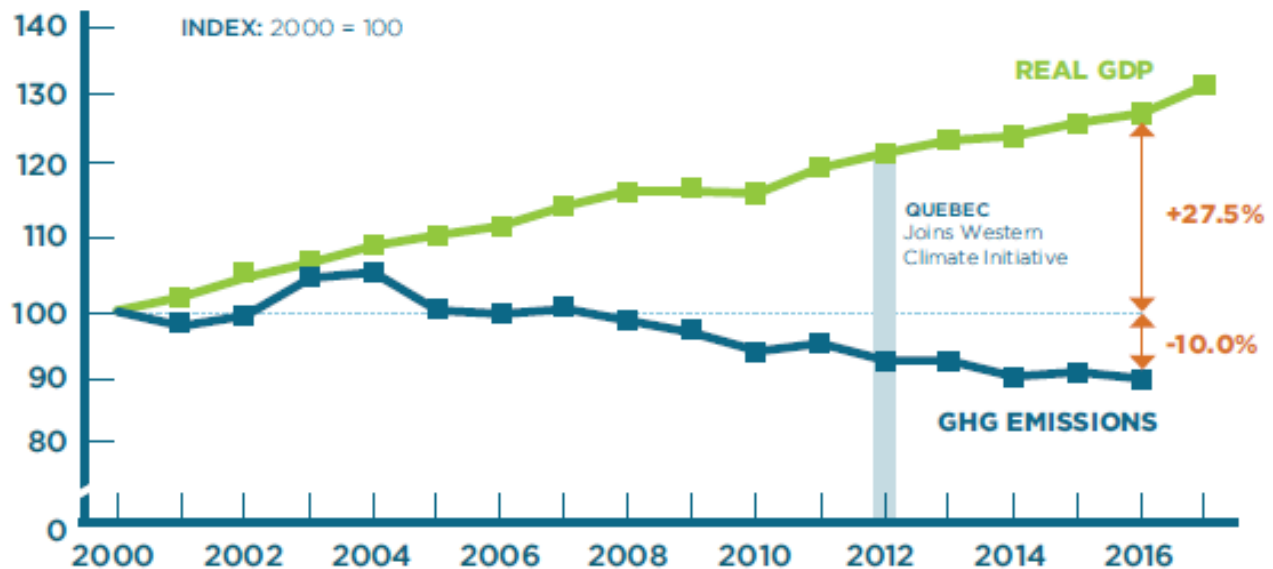


Figure 17 - Quebec GHG emissions and GDP (EAN)

Investments

⁹² <http://www.environnement.gouv.qc.ca/changements/carbone/documents-spede/strengths-advantages.pdf>

⁹³ <https://climate-xchange.org/wp-content/uploads/2018/08/Cap-and-Trade-Report-10.03.2018-compressed.pdf>

Quebec allocates all proceeds from its cap-and-invest auctions to finance the GHG emission reduction and climate change adaptation measures contained in its 2013-2020 Climate Change Action Plan (CCAP) through the CGFV.⁹⁴ These funds are disbursed to government departments for program implementation. CGFV revenue are accounted for separately from the department's appropriations. The floor price ensures minimum stable and predictable funding for these initiatives, making long-term planning possible. It is estimated that the program will have about \$3 billion (CAD) by 2020 from the cap-and-invest auctions.

In accordance with the legislative framework,⁹⁵ CGFV investments related to energy are intended to accomplish the following.

- Reduce, limit or prevent greenhouse gas emissions
- Mitigate the economic and social consequences of measures established for that purpose
- Promote ways of adapting to the impacts of global warming and climate change

The fund is to be used to finance activities, projects and programs that address these goals.

- Stimulating technological innovation
- Research and development
- Knowledge acquisition
- Performance improvement

The fund supports efforts in the following categories.

1. Energy
2. Transport
3. Research and innovation
4. Rehabilitation of contaminated land
5. Residual materials and agriculture
6. Awareness raising, partnerships and exemplary state (lead by example)
7. International climate cooperation

To date more than 20 programs and initiatives have been launched, including \$102.5 million (CAD) for electric vehicle incentives, \$5.2 million (CAD) for electric vehicle infrastructure and \$23 million (CAD) for mode shifts to active transportation.⁹⁶ Approximately 25% of Canada's population resides in Quebec and yet more than 50% of Canada's electric vehicle registrations are in Quebec.

From 2014-20, Quebec anticipates proceeds from auctions on the order of \$3.3 billion (CAD). These funds are being used as follows.⁹⁷

⁹⁴ The Green Fund also receives funds from waste disposal and water use charges. Waste disposal revenue is largely distributed to municipalities.

⁹⁵ Legislative framework established in Section 15.1 of Chapter M-30.00195.

⁹⁶ <http://www.environnement.gouv.qc.ca/changementsclimatiques/bilan/Feuillet-Solutions-LCC.pdf>

⁹⁷ <https://www.linkedin.com/pulse/green-fund-important-tool-qu%C3%A9becs-sustainable-david-heurtel/>

- Two-thirds to support transportation projects, mainly for the development of public transportation, and investing in transportation electrification, notably by offering citizens and businesses a rebate of up to \$8,000 (CAD) for the purchase of an electric vehicle,⁹⁸ as well as grants for installing charging stations at home and at the workplace⁹⁹
- Development of a new, more sustainable, lower-carbon economy by allowing innovative, job-creating projects to emerge¹⁰⁰
- Improved energy efficiency services for businesses, municipalities, institutions and citizens
- Support for the replacement of fossil fuels with renewable energy or energy sources that emit fewer GHGs and foster the use of new processes that are cleaner and more efficient
- Technological innovations, such as carbon capture and reuse

Governance

CGFV is administered by a board of directors composed of nine members appointed by the government.^{101,102}

- A president and chief executive officer (for a five-year term)
- Three members from the government, including a member representing the minister responsible for the administration of [the Department of Sustainable Development, Environment and Parks Act](#) and a member representing the minister responsible for Finance
- Five independent members from civil society and appointed considering the competency and experience profiles established by the board of directors

The management board is charged with providing a perspective of sustainable development, efficiency and effectiveness to its deliberations and oversees the governance of the CGFV.

The CGFV signs agreements with partner departments and agencies for the implementation of the measures provided for in the 2013-2020 Climate Change Action Plan and ensures compliance with the commitments made.

The CGFV also has accountability responsibilities, including the submission of an annual management report including the Green Fund's financial statements, the Green Fund accounts and the list of measures funded.

⁹⁸ Quebec has 11,767 registered plug-in vehicles as of Q3 2018: <https://www.fleetcarma.com/electric-vehicles-sales-update-q3-2018-canada/>

⁹⁹ Quebec has more than 1500 public charging stations.

<http://www.vehiculeselectriques.gouv.qc.ca/english/decouvrir/recharge/recharge-publique.asp>

¹⁰⁰ Examples include the E-Lion electric bus manufacturing company, the biomethanization plant in the municipality of Saint-Hyacinthe and the Téo Taxi project.

¹⁰¹ <http://www.environnement.gouv.qc.ca/cgfv/conseil-administration.htm>

¹⁰² As of March 2019, Quebec's government is actively considering a new governance structure.

A complete list of market components is shown in Appendix 2.

Lessons Learned

In 2017, the Quebec government passed the Act to amend the Environment Quality Act, which made significant changes to the law detailing the management of the CGFV. Changes include the creation of a management board that reports to the minister of the Environment and Climate Change.

The CGFV had accumulated a surplus of nearly \$1 billion (CAD), due in part to not having shovel-ready projects. Ensuring that projects are ready to go, have strong accountability for the use of funds and provide clarity of program goals should be part of any system Vermont creates.

A December 2018 report highlights concerns on the restrictions on the use of the funds and the accountability for their use. Funds were used to cover existing budget obligations rather than GHG reduction projects. Applications for program funding were confusing to applicants – with six separate programs for electric vehicle infrastructure, for instance.¹⁰³

It should also be noted that Quebec achieved 100% compliance by covered entities and they have the strictest penalties of the three systems reviewed.

Appendix 1 - Glossary of Terms

Adjusted budget – In RGGI the adjusted budget is the maximum number of allowances available for distribution in that year minus offset and cost containment reserve (CCR) allowances. Note this is one of the ways RGGI is addressing an oversupply of banked allowances.

Allowance – An allowance is a tradeable instrument linked to a specified amount of emissions, e.g., 1 metric ton of CO₂ per allowance. Allowances can be purchased, sold or freely allocated by the administering entity to obligated entities, in accordance with market rules. An allowance converts the value of the covered pollutant into a monetary instrument. The total amount of allowances is equal to the annual allowance budget specified in the cap. For example, if the total emissions cap is 90 million metric tons of CO₂, and each allowance is valued at 1 metric ton, there will be 90 million allowances issued.

Allowance allocation – The program design will consider how to allocate allowances to different entities. It is common to allocate at least some allowances for free to prevent emissions “leakage” (the transfer of emissions-intensive activities like manufacturing to jurisdictions without a carbon price) and/or to address energy intensive, trade exposed industries. These industries are usually identified by the state and can include energy intensive industries like cement, glass and steel as well as those that could move

¹⁰³ <https://montrealgazette.com/news/quebec/quebecs-green-fund-will-be-overhauled-following-report-millions-dormant>

operations to a jurisdiction without a cap-and-invest system or carbon price in effect.¹⁰⁴ Allowances remaining after free allocations are then assigned to obligated entities in proportion to their obligation.

Auction holding account – An account held by a regulator or auction manager that keeps allowances that were not sold at auction. In the California market, allowances held in this account are not placed back in the market until the auction price has exceeded the floor price in two consecutive auctions; and no more than 25% of total allowances available at a quarterly auction can come from the auction holding account.¹⁰⁵

Banking – Banking is the process that allows an entity to purchase or hold allowances beyond what is needed to meet their obligation. The amount, value and lifespan of banked allowances is set by the market rules.

Base budget – In RGGI this refers to the maximum number of allowances without any adjustments for offsets or cost containment reserve (CCR) allowances.

Borrowing – Allows obligated entity to use future year allowances to meet current year obligations. It is the opposite of banking.

Carbon leakage – Refers to the potential for obligated parties to move operations to jurisdictions outside the area covered by the cap-and-invest system. Leakage also can refer to upstream effects of compliance activities with a program originating in another jurisdiction. For instance, it is a form of leakage if a utility in a complying state purchases out-of-state renewables that in turn causes consumers in the nonparticipating state to rely more on fossil-fueled generation. The more jurisdictions that are covered by a system, the lower the opportunity for carbon leakage.

Compliance obligation – A compliance obligation is equivalent to the quantity of allowances or offset credits an entity must acquire. An entity can meet this obligation by purchasing allowances at auction, reducing their emissions, using previously banked allowances and/or investing in offset projects.

Compliance periods – Compliance periods are the times during which obligations must be met. Cap-and-invest systems often have three-year compliance periods. This allows covered entities to meet their obligations over normal business and economic cycles.

Complementary policies – Complementary policies can influence the price and the pace of emissions reduction. Such policies can include low-carbon fuel standards, renewable portfolio standards, vehicle fuel economy standards, zero emission vehicle standards, building codes, appliance standards, building labeling and feebates.

Consignment allowances – In the California market these refer to allowances provided to electric and natural gas utilities to benefit ratepayers. The value these allowances receive in the auction is returned to ratepayers in the form of a “climate dividend” that appears quarterly on utility bills. Investor-owned

¹⁰⁴ <https://olis.leg.state.or.us/liz/201711/Downloads/CommitteeMeetingDocument/150062>

¹⁰⁵ <https://onclimatechangepolicydotorg.wordpress.com/carbon-pricing/price-floors-and-ceilings/>

utilities must put all their allowances in the market. Publicly owned utilities and cooperative utilities can determine how to use their allowances.

Costs containment reserve (CCR) – When auction prices reach a value determined by the market administrator, allowances above the cap are released to temper the market. The CCR is triggered if emission reduction costs are higher than projected. A CCR can be a component of a “soft” ceiling if a limited number of allowances are released or it can be a “hard” ceiling if it releases an unlimited number of allowances. See Figure 2.

Covered entity – Sometimes referred to as “obligated parties,” this is an entity within the jurisdiction that meets the criteria established to be a covered entity. In most cases the criteria for being a covered entity is articulated as an entity that emits more than the established tons of the pollution in a sector that the cap-and-trade system is seeking to reduce.

Credits – Offset activities generate credits, rather than allowances. Credits are earned through investments in offset projects, whereas allowances are allocated or purchased. Offset credits can reduce the number of allowances needed to meet an entity’s obligation.

Emissions containment reserve (ECR) – If prices fall below established trigger prices, the cap is reduced to drive additional emissions reductions and stabilize prices. ECR is the corollary to CCR. See Figure 2.

Free allowances – Sometimes called free allocations. These allowances are usually given to energy intensive, trade exposed (EITE) industries. A jurisdiction can determine which of its entities should be awarded free allowances for either all or part of their obligations and for how long such free allowances should be provided.

Fugitive emissions – These are leaks, unintended or irregular releases of covered emissions. Accounting for these emissions is commonly addressed in the regulatory process and in the measurement and verification of a covered entity’s activity.

Green Fund (CGFV) – The name of the fund that receives and disburses proceeds from the auctions held for the Quebec system. Its abbreviation stands for Conseil de gestion du Fonds vert.

Greenhouse Gas Reduction Fund (GGRF) – The name of the fund that receives and disburses proceeds from the auctions held for the California system.

Holding limits – The holding limit is the maximum number of allowances that an entity may hold at one time. California and Quebec have established holding limits for 2018-30¹⁰⁶ that are in the range of 3% of total allowances. That is, no entity can hold more than around 3% of total allowances.

Market integrity – This refers to mechanisms to ensure a transparent, secure registry that can track transactions and prevent theft and allows for double counting of allowances. In addition, most jurisdictions select independent experts to review transaction data and watch for fraud. Additional

¹⁰⁶ https://www.arb.ca.gov/cc/capandtrade/holding_limit.pdf

market oversight of some secondary carbon markets (the trading of allowances between individuals and/or firms) is provided by the Commodity Futures Trading Commission (CFTC).

Offsets – Offsets are activities that reduce an obligated entity’s need to purchase allowances through actions unrelated to the emissions generated by a covered entity. For instance, a carbon offset project, such as forest preservation or reforestation can be purchased, or invested in, by a covered entity to offset its emissions and thus reduce the amount of allowances it needs to acquire.

Opt-in covered entity – An entity within a covered sector that emits less than the threshold to become a covered entity may voluntarily provide allowances for its emissions. This allows smaller polluters to participate in the program and provides the opportunity to monetize the value of pollution reduction strategies they have adopted. For instance, an entity within a covered sector, say home heating, that pollutes less than the threshold to be covered, say 25,000 MTCO₂e annually, and reduces its pollution by selling and servicing cold climate heat pumps rather than fuel, could monetize this transition by selling allowances equivalent to the amount of pollution reduction attained. In Vermont this could present an opportunity to partner with a utility in meeting their Tier 3 obligations under the state’s renewable energy standard.

Participating entity – A participating entity is any entity, whether obligated, opt-in or a voluntary participant that is purchasing and trading allowances. All obligated entities are participating entities, but not all participating entities are obligated entities.

Price ceiling – This is the maximum price, set by the market administrator, for the price of allowances. Market managers can deploy tools to temper prices should they reach certain levels by releasing additional allowances. See Figure 2.

Price collar – This refers to the difference between the floor price and the ceiling price. See Figure 2.

Price corridor – Like the price collar, the price corridor refers to the transaction activity occurring between the floor and ceiling. See Figure 2.

Price floor – This is the minimum price set by the market administrator for allowances to be sold. It provides greater certainty and stability for investors knowing that the value of the investment has a floor price. See Figure 2.

Regional Greenhouse Gas Initiative (RGGI) – RGGI is a cooperative effort, started in 2005, between the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont to develop and implement a cap-and-invest system to reduce CO₂ emissions from the electricity generating sector. It held its first auction in 2008.

Reserve price – This is a mechanism to establish a “soft” floor price in that prices can dip below this level leading to unsold allowances. Like a reserve in a real estate auction, it is a level below which the item or allowance is not sold.

RGGI, Inc. – A 501(c)(3) nonprofit corporation created to support development and implementation of the Regional Greenhouse Gas Initiative (RGGI). RGGI, Inc.'s exclusive purpose is to provide administrative

and technical services to support the development and implementation of each RGGI state's CO₂ budget trading program.

Scope – This describes the sources and types of pollution that will be covered by a program. For administrative ease, programs tend to include only the largest sources of the targeted pollution. For the electricity generating sector, CO₂ cap-and-invest programs include the fossil-fuel generating plants and not the end users of electricity.

Target – This refers to the level of reductions required and the timeline to achieve them. Often near- and long-term targets are set with compliance periods breaking the goals into shorter time frames. Targets are set by the implementing agency in accord with established governance procedure.

Transportation Climate Initiative (TCI) – Is a regional collaboration of 12 Northeast and mid-Atlantic states¹⁰⁷ that seeks to develop the clean energy economy and reduce oil dependence and greenhouse gas emissions from the transportation sector.

Voluntarily associated entity – VAEs are entities that are not covered entities but intend to purchase, hold, sell, clear or voluntarily retire allowances or offset credits. These entities may be purchasing allowances with the expectation that their value will increase, and they will then sell them for a profit or voluntarily retire allowances in support of environmental or other goals.

Western Climate Initiative (WCI) – A multijurisdictional collaboration that seeks to develop regional strategies to address climate change in North America.

WCI, Inc. – A nonprofit corporation formed to provide administrative and technical services to support the implementation of state and provincial greenhouse gas emissions trading programs. California and Quebec are the two principal participating jurisdictions. They formally linked their cap-and-invest systems under the umbrella of WCI in 2014, forming the largest carbon market in North America.

¹⁰⁷ Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont and Virginia.

Appendix 2 - Market Components of California, RGGI and Quebec Systems

	California	RGGI	Quebec
Allowance Price	\$15.05 (August 2018)	\$5.27 (March 2019)	\$15.05 (August 2018)
Allowances that Go to Auction	50% (2015-18)	90+%	67%
Banking	A participating entity may bank allowances for future use and these allowances will not expire. However, regulated entities are subject to holding limits, restricting the maximum number of allowances that an entity may bank at any time. The holding limit quantity is based on a multiple of the entity's annual allowance budget.	Banked allowances may be used in future compliance periods. Budgets are adjusted to account for any banked allowances currently in the market.	Allowances subject to a general holding limit.
Borrowing	Not allowed	Not allowed	Not allowed
Cap (tons of CO₂)	346.3 million (2019), reduces by 3.5% in 2020 to 334.2 and to 193.8 in 2030	80 million short tons, 58.3 million short tons adjusted cap (2019), cap declines 2.5% a year through 2020. 52.4 million tons by 2030	56.85 million (2019) to 41.14 (2030)
Compliance Period	Three years, currently in third three-year period.	Three years, currently in its fourth three-year period (2018-20). Covered entities must cover 50% of their emissions in each of the first two years of a compliance period and 100% by the end of the period.	Three years, currently in third three-year period.

Cost Containment Reserve	Three tiers of allowance trigger prices, each with 40,611,00 allowances. In 2021: Tier 1 - \$41.40/allowance Tier 2 - \$53.20/allowance Tier 3 - \$65.00/allowance. This will be the price ceiling. Prices increase by 5% plus inflation annually.	CCR trigger price will increase by 2.5% per year through 2020, and it will be 10 million allowances each year. In 2021 the CCR trigger price will be \$13.00 and will increase by 7% per year thereafter. The CCR's size will be 10% of the regional cap each year.	Three tiers at CAD 56.96, CAD 64.07, and CAD 71.19 in 2019. Only covered entities are eligible to purchase allowances from the reserve. Reserve prices increase annually by 5% plus inflation.
Covered Entities	Entities that emit more than 25,000 million metric tons of CO ₂ equivalent a year.	Electric generating units that are at or above 25 MW capacity.	Businesses that emit 25,000 million metric tons or more of CO ₂ equivalent a year are subject to the cap-and-trade system.
Covered Sectors	Suppliers of natural gas, reformulated blendstock for oxygenate blending and distillate fuel oil, liquid petroleum gas and liquified natural gas, industrial facilities, electricity generation, electricity imports, other stationary combustion and CO ₂ suppliers. Refiners and importers of transportation.	Electricity generations.	Electricity distributors, industry that emit more than 25,000 million metric tons of CO ₂ equivalent a year, distributors and importers of fuels used in transportation and buildings of 200 or more liters.
Emissions Containment Reserve	None	2021=\$6.00. Increasing by 7% each year thereafter.	Reserve emission units held in the allowance price containment reserve account may be sold at CAD \$53.37 (USD \$69.27), \$60.04 (USD \$77.93), \$66.71 (USD \$86.59)/t CO ₂ e in 2018.
Emissions Covered	80% of GHG emissions. CO ₂ , CH ₄ and N ₂ O, SF ₆ , HFCs, PFCs, NO ₃ and other fluorinated GHGs.	20% of all GHG emissions. CO ₂	85% of all GHG emissions. CO ₂ , CH ₄ , N ₂ O, SF ₆ , HFCs, PFCs, NO ₃ and other fluorinated GHGs.

<p>Enforcement</p>	<p>Fines and possible imprisonment.</p>	<p>Penalties set by each state. RGGI requires three times the amount of any excess emissions to be surrendered in future compliance periods.</p>	<p>For noncompliance fines of CAD \$3,000-500,000 and 18 months in jail for an individual and between \$10,000 and \$3 million for an entity. Fines doubled for second offense. If allowances are not covered at the end of the compliance period entity must surrender three additional allowances as well as the missing allowances.</p>
<p>Equity</p>	<p>Half of offset credits purchased must go toward projects that benefit CA. The CalEPA identifies disadvantaged communities for California Climate Investments</p> <p>A minimum of 25% of the GGRF monies to be allocated for projects that provide benefits to disadvantaged communities</p> <p>A minimum of 25% of GGRF monies to be allocated for projects located within disadvantaged communities</p> <p>A minimum of 5% to projects that benefit low-income households or to projects located within low-income communities located anywhere in the state</p>	<p>Vermont does not require a percentage of funds be spent on programs or projects that specifically benefit disadvantaged communities.</p>	<p>Money generated from cap-and-trade system goes into the Quebec Green Fund. There are no equity set-asides.</p>

	A minimum of 5% to projects that benefit low-income households and low-income communities that are outside of, but within a half mile, of a disadvantaged community		
First Auction Date	2012 for electricity, 2014 for transportation and heating fuels	2009	2012 for electricity, 2014 for transportation and heating fuels
Free Allowances	17% of total allowances. Electrical distribution utilities and natural gas suppliers that must return the value to their ratepayers (consignment allowances). Energy-intensive, trade-exposed industrial facilities based on leakage risk, benchmarks and production volumes.	Allowances are distributed per each state's regulation and statute. Vermont does not provide free allowances.	30% for emissions-intensive, trade-exposed industries
Investments	Must meet policy objectives established in statute.	At least 25% must be spent for consumer benefit or strategic energy purposes.	In accord with the Climate Action Plan (2013-20).
Number of Covered Entities	450	165	132

<p>Offsets</p>	<p>Limited to 8% of obligation, reduces to 4% between 2021-25. Every year allowances and offsets must be turned in for 30% of the previous years' emissions. After which there becomes a limited stock of offsets allowing for greater use of allocations. Offset types allowed:</p> <ol style="list-style-type: none"> 1. U.S. forest projects 2. Urban forest projects 3. Livestock projects (methane management) 4. Ozone-depleting substances projects 5. Mine methane capture (MMC) projects 6. Rice cultivation projects 	<p>Maximum of 3.3% of compliance obligation can be met by offsets. Five offset types are allowed:</p> <ol style="list-style-type: none"> 1. Landfill methane capture and destruction 2. Sequestration of carbon due to reforestation, improved forest management or avoided conversion 3. Avoided methane emissions from agricultural manure management operations 4. Reduction or avoidance of CO₂ emissions from natural gas, oil or propane end-use combustion due to end-use energy efficiency (discontinued in 2021) 5. Reduction in SF₆ emissions (discontinued in 2021) <p>One offset project (landfill methane capture and destruction) has been approved since the program's start.</p>	<p>Up to 8% of obligation (reduces to 4% in 2021). Five types of offsets are allowed:</p> <ol style="list-style-type: none"> 1. CH₄ destruction as part of projects to cover manure storage facilities 2. Capture of gas from specified landfill sites 3. Destruction of certain ozone depleting-substances contained in insulating foam and of certain refrigerant gases recovered from domestic appliances in Canada 4. Capture and destruction of CH₄ from a CH₄ drainage system at an active underground or surface coal mine, except a mountaintop removal mine 5. Capture and destruction of CH₄ from the ventilation system of an active underground coal mine
<p>Opt-in Entities</p>	<p>Permitted</p>	<p>Permitted</p>	<p>Beginning in 2019 entities that emit between 10,000 and 25,000 tCO₂e/year. Only covered entities are</p>

			eligible to purchase allowances.
Point of Regulation	Electricity – generators and importers (upon delivery to state) Large industrial facilities – operators Transportation fuels at “the rack” prior to distribution ¹⁰⁸ Fuel suppliers who either hold an inventory position of fuels in the bulk transfer/terminal system or import fuel into California outside the bulk transfer/terminal system. ¹⁰⁹	At installation level	Fuel distributors
Polluter Reporting Requirement	Above 10,000 MTCO ₂ e	VT - EPAs 25,000 MTCO ₂ e requirement	Above 10,000 MTCO ₂ e
Price Ceiling	Soft price ceiling, hard ceiling to be set in 2021 at \$65.	\$10.25 - soft ceiling, once hit cost containment reserve allowances are released	No ceiling
Price Floor	2019 - \$15.62 Increasing 5% plus inflation annually	2019 - \$2.25 Increasing by 2.5% annually	2019 - \$11.82 USD For joint auctions with California in 2019, the highest of Quebec's or California's annual price, increasing by 5% plus inflation until 2030
Registered Emitters (not all are covered entities)	800	7 in Vermont	176

¹⁰⁸ https://www.ieta.org/resources/Resources/Case_Studies_Worlds_Carbon_Markets/2018/California-Case-Study-Jan2018.pdf

¹⁰⁹ https://www.arb.ca.gov/cc/capandtrade/guidance/faq_fuel_purchasers.pdf

Target	<p>2019: 346.3 million GHG allowances. 2020 return to 1990 levels.</p> <p>2030 - GHG emissions 40% below 1990 levels.</p>	<p>2020 - 50% reduction from 2005 levels of CO₂ emissions from electricity generation.</p> <p>2030 - 30% reduction from 2020 emissions cap.</p>	<p>2020 - 20% below 1990 levels.</p>
Utility Consignment	35%	N/A	N/A