

Standardized Regulatory Impact Assessment (SRIA) Proposed Amendments to the Cap-and-Trade Regulation

A. Summary

The Cap-and-Trade Program (Program) is a key element of California's greenhouse gas (GHG) reduction strategy. It establishes a declining limit on 85 percent of statewide GHG emissions, and creates a powerful economic incentive for major investment in cleaner, more advanced technologies. The Program also gives businesses the flexibility to choose the lowest-cost approach to reducing emissions.

This report presents the proposed amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation (Regulation or Cap-and-Trade Regulation) to make modifications to the Program in several areas for the start of the third compliance period in 2018 and to propose a post-2020 Program to realize the California GHG emissions target of 40 percent below 1990 levels by 2030, as stated in the Governor's Executive Order B-30-15. Amendments that would take effect for the third compliance period (2018-2020) include modifications to allowance allocation, inclusion of international offset credits generated through approved sector-based credit programs, streamlining of Program implementation in several areas, and linkage with the Cap-and-Trade Program in Ontario. The preliminary proposal (Amended Regulation) also includes declining annual caps for the post-2020 period, allocation methods for the post-2020 period, continued linkage with Québec for the post-2020 period, and alignment of compliance periods to support California's compliance demonstration for the federal Clean Power Plan. Providing Board approval and subsequent certification by California's Secretary of State, the Amended Regulation is expected to be effective October 1, 2017 with full implementation on the same date.

Background

California's Cap-and-Trade Regulation was adopted by ARB in October 2011. The Regulation took effect on January 1, 2012. The first auction of emission allowances occurred in November 2012, and the first compliance period began on January 1, 2013. On January 1, 2014, California and Québec formally linked their Cap-and-Trade Programs, allowing transfers of compliance instruments between the two jurisdictions.

The Program establishes a hard declining cap on approximately 85 percent of total statewide GHG emissions. ARB issues allowances equal to the total amount of permissible emissions over a given compliance period. Each compliance period represents either a 2-year or 3-year block in the Program, 2013-2014, 2015-2017, and 2018-2020. Having multiyear compliance periods allows for smoothing of annual emissions variations that may be due to drought or unique production conditions. One allowance equals one metric ton of carbon dioxide equivalent (using the 100-year global warming potential). As the cap declines over time, fewer allowances are issued, ensuring that emission reductions occur.

Under the Program, individual firms do not have facility-specific emissions reduction requirements. Rather, all regulated parties are required to surrender allowances in an amount equal to their total GHG emissions during each compliance period. Firms can also meet a portion of their compliance requirements by surrendering offset credits, which are rigorously verified emission reductions that occur from projects outside the scope of the Program.

The Program gives firms the flexibility to either find methods to reduce emissions at their own facilities, trade allowances with other firms, or purchase allowances at auction. Through these mechanisms, the Program is designed to leverage the power of the market to find the most cost-effective methods to reach California's environmental goals. The ability to auction and trade emissions allocations establishes a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy, and affords those regulated by the program flexibility to seek out and implement the lowest-cost options to reduce emissions.

In 2012, ARB proposed two sets of amendments to the Regulation. The first set of amendments, related to program implementation, was approved by the Board in June 2012. These amendments took effect in September 2012. The second set of amendments, related to jurisdictional linkage with Québec, was approved by the Board in April 2013. These amendments took effect in October 2013 and specified a January 1, 2014 start date for the linked California and Québec Cap-and-Trade Programs.

In 2013, ARB proposed another set of amendments to the Regulation. The amendments extended transition assistance (free allowance allocation to the industrial sector at the outset of the Program to avoid sudden or undue short-term economic impacts and to promote a transition to a low-carbon economy) for some covered entities, refined the required data collected from registered participants to support market oversight, and added an additional cost containment measure. These amendments also included a new compliance offset protocol, Mine Methane Capture, and updates to offset implementation and usage. The Board approved these amendments in April 2014 and they took effect on July 1, 2014.

In 2014, ARB proposed yet another set of amendments to the Regulation. The amendments clarified the quantification of production data, updated the compliance offset protocols, and modified requirements related to compliance, corporate association disclosures, and offset transfer price reporting related to the transaction of market instruments. The Board approved these amendments in September 2014 and they took effect on January 1, 2015.

Proposed Regulatory Amendments

The Amended Regulation analyzed in this report builds on the currently enforced Regulation, including all Board approved amendments. The public process for the Amended Regulation began in late 2015, with publicly noticed workshops in October 2015, December 2015, February 2016, and March 2016. A meeting of the

Environmental Justice Advisory Committee (EJAC) in January 2016 also included a public discussion of the Amended Regulation. These forums provided opportunity for stakeholder comment and for the solicitation of alternatives to the Amended Regulation. The timeframe of the workshops allowed ARB to incorporate comments and alternatives into this analysis. ARB is holding additional workshops to help inform the Amended Regulation, and ARB considers stakeholder feedback throughout the regulatory adoption process, including up to the adoption of the final regulation. Thus, this analysis represents a snapshot of the Amended Regulation, and the costs and compliance requirements represent the best information available to ARB at the time of the SRIA submittal.

The Amended Regulation analyzed in this report may differ from the proposed Amended Regulation presented to the Board in July 2016, which will be informed by continued interactions with stakeholders, the EJAC, the public, external researchers, other regulatory agencies, as well as by direction the Board may provide to ARB staff at Board hearings. The Initial Statement of Reasons (ISOR) will include an economic analysis of the final proposed Amended Regulation, and may rely on additional information and analysis techniques. Over the course of the next year, as the Amended Regulation is finalized, additional supporting documents for the economic analyses may also be added to the rulemaking record.

In addition, as there is uncertainty regarding the future allowance price, the analysis focuses on the potential economic impacts of the Amended Regulation under a range of Cap-and-Trade allowance prices. Including a range of prices allows the analysis to assess the potential impact on the Cap-and-Trade allowance price of policy choices such as including the method for allocating allowances, using auction proceeds, linking with other jurisdictions, as well as factors such as the cost of GHG emission reduction technology, and potential impacts to energy and fuel prices.

The Amended Regulation will include changes to industrial allocation, the number of free allowances given to regulated industrial entities, for the third compliance period pending the results of leakage studies that are expected to be completed this spring. AB 32 requires ARB to minimize leakage, which is defined as “a reduction in GHG emissions within the State that is offset by an increase in GHG emissions outside the state” (Section 38505(J)). Leakage occurs when industry or production moves out of state in response to increased costs due to the California price on carbon. As a result, there appears to be a reduction in GHG emissions for AB 32 statewide accounting purposes, but the atmosphere does not experience a net reduction in GHG emissions.

Amendments are also being considered to streamline the implementation of the Program now that ARB and regulated entities have gained several years of experience in the implementation of the existing Regulation. To support liquidity and cost containment, amendments are being considered to link with the Ontario Cap-and-Trade program that is currently under development and to include sector-based compliance offset credits in the Program beginning in 2018. Linkage can provide additional options for lower cost abatement, reduce concerns related to market power, as well as increase liquidity and potentially reduce volatility in the allowance market. Amendments

recognizing sector-based compliance offset credits for use in the Program can also provide cost containment by increasing the supply of low-cost offsets that can be used to fulfill the 8 percent offset usage limit.

For the post-2020 program, amendments will include setting the post-2020 cap. Amendments include a proposed cumulative emissions cap for the years 2021 through 2030 for the emissions sources covered by the program. This ten-year cap is divided into annual budgets, each of which specifies the number of allowances created for each year. The annual caps decline over time in support of the 2030 emissions target. Amendments also include allocation of allowances to covered entities, continued jurisdictional linkage with Québec and Ontario, and changes to compliance periods in the Program to support compliance with the federal Clean Power Plan.

The California Cap-and-Trade Program is currently linked with the Canadian province of Québec and is anticipating linking with the Canadian province of Ontario. The economic advantages of linking with other jurisdictions are analogous to the benefits of including multiple sectors under a broad California Cap-and-Trade Program. Expanding the number of sources that are able to trade allowances will reduce the overall cost of achieving emission reductions and improve the efficiency of the allowance market.

California, Québec, and Ontario, are members of the Western Climate Initiative (WCI), a collaboration among states and provinces to address climate change at a regional level. Within WCI, the three jurisdictions collaborated on the development of cap-and-trade program-design recommendations, providing a roadmap for program implement and harmonization. The similar design features and minimum stringency requirements facilitate linkage among the California, Québec, and Ontario programs. In addition, SB 1018 requires that the Governor make four findings prior linking the California Program with other jurisdictions. Under SB 1018, the Governor must find that the linked program:

- Has requirements that are equivalent to or stricter than the California Program
- Will allow for continued enforceability of AB 32
- Is fully enforceable within its own jurisdiction
- Does not impose liability on California

In 2014, Governor Brown made these four findings for linkage with Québec, confirming the relative stringency of the programs. The proposed linkage with Ontario will require the same four findings.

The effect of linkage depends on the relative size, stringency, cost of reductions, and availability of offsets in the linked Programs. The economic analysis for the 2012 amendments to California Program found that linking with Québec could cause the allowance price in California to remain unchanged or increase slightly.¹ It is anticipated

¹ <http://www.arb.ca.gov/regact/2012/capandtrade12/isormainfinal.pdf>

that linkage with the Ontario program would have a similar impact on the California Program, given the relative size, stringency, and cost of reductions available among the programs. Table 1 provides the jurisdictional GHG targets, which translates to cap setting for California, Québec, and Ontario.

Table 1: Jurisdiction GHG Targets

Target Year	California	Québec	Ontario
2020	Equal to 1990	20% below 1990 ²	15% below 1990 ³
2030	40% below 1990	37.5% below 1990 ⁴	37% below 1990 ⁵

A detailed economic analysis of a proposed linkage with Ontario and continued linkage with Québec will be included in the rulemaking record for public review and comment, prior to the Board’s consideration of the final Amended Regulation.

1. Statement of the Need of the Proposed Regulation

Climate Impacts

Climate change is one of the most serious environmental threats facing the world today. Global warming is already impacting the Western United States, particularly California, in more severe ways than the rest of the country. The 2010 Climate Action Team (CAT) report (CAT 2010) concluded that climate change will affect virtually every sector of the State’s economy and most of California’s ecosystems.⁶ Significant impacts will likely occur even under moderate scenarios of increasing global GHG emissions and resulting climate change.

When compared to the rest of the country, California is particularly vulnerable to significant resource and economic impacts from at least three effects of climate change. First, as sea level rise and coastal erosion and flooding increase, California (with its long coastline) will experience loss of, and damage to, coastal property, infrastructure, recreational beaches, wildlife habitat, and coastal water supplies. Second, California relies on its snowpack for water supply and storage, and this resource is predicted to decrease substantially this century. Third, California’s urban, suburban, and rural areas are highly impacted by wildfires in ways most of the country simply does not face, and climate change will increase the incidence and severity of wildfires and resulting air quality and economic impacts.

² http://www.mddelcc.gouv.qc.ca/communiqués_en/2009/c20091123-cibleges.htm

³ <https://news.ontario.ca/ene/en/2015/05/ontario-first-province-in-canada-to-set-2030-greenhouse-gas-pollution-reduction-target.html>

⁴ <http://www.mddelcc.gouv.qc.ca/changementsclimatiques/consultations/cible2030/index-en.htm>

⁵ <https://news.ontario.ca/ene/en/2015/05/ontario-first-province-in-canada-to-set-2030-greenhouse-gas-pollution-reduction-target.html>

⁶ Climate Action Team (2010) Report to the Governor and Legislature, <http://www.energy.ca.gov/2010publications/CAT-1000-2010-004/CAT-1000-2010-004.PDF>.

North America is also experiencing the effects of climate change. Annual mean air temperature in North America has increased over the past forty years (Füssel 2009; Pederson et al. 2010).⁷ More frequent and intense extreme weather events have impacted ecosystems, increased coastal damage, and affected a considerable proportion of people (Christensen et al. 2007; Emanuel et al. 2008).⁸

Extreme weather events have also had severe impacts on transportation systems, energy supplies, and other industries in North America. For example, major hurricanes in 2004 and 2005 in the United States affected oil and natural gas platforms and pipelines, creating billions of dollars in restoration costs for public utilities and transportation networks on the regional and national level (EEI 2005).⁹

More cities are forecast to experience extreme heat waves, increasing sea levels, increased numbers of dangerous storm surges, water shortages, droughts, and increased flooding. In addition, severe heat waves, extreme weather events, and air pollution generated by climate change may cause social disruption and increase human losses and injuries, as well as vector-borne diseases.

It is important that California works to reduce GHG emissions in order to decrease the probability of these impacts. Ten years ago the California Global Warming Solutions Act of 2006 (AB 32, Nuñez, Chapter 488, Statutes of 2006) was enacted to begin to address this public problem by reducing GHG emissions in a cost-effective manner. AB 32 directed ARB to continue to be a global leader and to develop integrated and cost-effective regional, national, and international GHG reduction programs (AB 32, Nuñez, Chapter 488, Statutes of 2006). In 2015, Governor Brown issued Executive Order B-30-15 (EO B-30-15) to set a goal of reducing GHG emissions to 40 percent below 1990 statewide levels by 2030.

⁷ Füssel, H.M. (2009). An updated assessment of the risks from climate change based on research published since the IPCC Fourth Assessment Report. *Climatic Change*, 97, 469–482.

Pederson, G.T., Graumlich, L.J., Fagre, D.B., Kipfer, T., & Muhlfeld, C.C. (2010). A century of climate and ecosystem change in Western Montana: what do temperature trends portend? *Climatic Change*, 98, 133–154.

⁸ Christensen, J.H., Hewitson, B., Busuioc, A., Chen, A., Gao, X., Held, I., Jones, R., Kolli, R.K., Kwon, W.T., Laprise, R., Magaña Rueda, V., Mearns, L., Menendez, C.G., Räisänen, J., Rinke, A., Sarr, A., & Whetton, P. (2007). Regional climate projections. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K.B., Tignor, M. & Miller, H.L. Eds., Cambridge University Press, Cambridge and New York, 847-940. Emanuel, K., Sundararajan, R., & Williams, J. (2008). Hurricanes and global warming—results from downscaling IPCC AR4 simulations. *Bull Am Meteorol Soc*, 89(3):347–367.

⁹ EEI (2005). *After the Disaster: Utility Restoration Cost Recovery*. Edison Electric Institute (EEI), Washington, District of Columbia, 27.

[http://www.eei.org/industry_issues/reliability/nonav_reliability/Utility Restoration Cost Recovery.pdf](http://www.eei.org/industry_issues/reliability/nonav_reliability/Utility_Restoration_Cost_Recovery.pdf).

Accessed 02 September 2009.

California Climate Change Scoping Plan

EO B-30-15 also directs ARB to update the California Climate Change Scoping Plan (Scoping Plan), in collaboration with other state agencies, to establish the path for realizing the 2030 GHG emission limit. In 2008, the first Scoping Plan laid out a comprehensive program to reduce California's greenhouse gas emissions to 1990 levels by 2020, to reduce the state's dependence on fossil fuels, to stimulate investment in clean and efficient technologies, and to improve air quality and public health. The coordinated set of policies in the Scoping Plan employed strategies tailored to specific needs, including market-based compliance mechanisms, performance standards, technology requirements, and voluntary reductions. The Scoping Plan described a conceptual design for a cap-and-trade program that included eventual linkage to other cap-and-trade programs to form a larger regional trading program. California's Cap-and-Trade Regulation was developed concurrently with WCI design documents that provide a template for a regional cap-and-trade program, which led to linkage with Québec and the proposed linkage with Ontario. As implemented, the Program is designed to work in concert with other measures, such as standards for cleaner vehicles, low-carbon fuels, renewable electricity, and energy efficiency. The Program also complements and supports California's existing efforts to reduce criteria and toxic air pollutants.

ARB began a process to update the Scoping Plan with a series of symposia and kickoff workshops in summer and fall 2015. At this time, ARB is coordinating with other state agencies, economic reviewers, the EJAC, and holding public workshops to complete the process of updating the Scoping Plan for final Board consideration in late 2016. Concurrent to the Scoping Plan process, the Cap-and-Trade Regulation is being amended to modify existing requirements for the third compliance period, which begins in 2018, and for a potential post-2020 program to support achieving the 2030 statewide GHG target. ARB has heard from the regulated community, and agrees, that long-term signals for GHG reductions are critical for efficient compliance planning and to provide the incentive to make onsite investments to reduce GHGs.

To support continued and sustained incentives for investment action to reduce GHGs, the process to amend the Regulation for the third compliance period and the post-2020 period has to be conducted concurrently to the update of the Scoping Plan. A stable long-term GHG emissions reduction signal is also important as ARB pursues additional linkages with other programs and continues its existing linkage with Québec's program. The Amended Regulation is anticipated for final Board consideration in spring 2017, prior to the start of the third compliance period. This schedule and the Administrative Procedure Act for rulemakings allows for the final Amended Regulation to be adjusted in response to the final Scoping Plan if necessary. It is anticipated that the final 2030 Target Scoping Plan will be heard by the Board at the end of 2016.

2. Major Regulation Determination

The Amended Regulation was determined to be a major regulation as preliminary modeling results for amendments related to the post-2020 Program show a greater than

\$50 million economic impact over a 12-month period after full implementation. Proposed changes to the Regulation for the third compliance period are anticipated to have a small economic impact. Therefore, the focus of this report will be on the regulatory amendments related to the post-2020 Cap-and-Trade Program.

3. Baseline Information

To estimate the economic impacts of the Amended Regulation, a baseline or business-as-usual (BAU) characterization of California GHG emissions was developed. The BAU outlines the estimated emissions reductions that the Amended Regulation may require based on estimates of California GHG emissions through 2030 and on assumptions about post-2020 California climate policy. In this report, the economic baseline used in analyzing the impact of the Amended Regulation and two alternatives is the reference case adjusted to reflect the Department of Finance Conforming Forecast, dated June 2015.

The initial AB 32 Scoping Plan outlined a range of GHG reduction actions, including direct regulations, alternative compliance mechanisms, monetary and non-monetary incentives, voluntary actions, market-based mechanisms, and an AB 32 program implementation fee regulation to fund the program. This approach was recommended by the Market Advisory Committee as multiple approaches including a cap-and-trade program and direct, technology-oriented policies are needed to address multiple market failures.¹⁰ California's climate policy, therefore, is a portfolio of measures, including the renewable portfolio standard, the Low Carbon Fuel Standard, aggressive energy efficiency programs, the Cap-and-Trade Program, and other GHG reduction strategies. Post-2020, California's climate policy will continue to include complementary market and direct regulatory policies to address the multiple market failures associated with GHG emissions.

To meet the 2030 emissions target, GHG emissions allowed under the post-2020 Cap-and-Trade Program, plus emissions from facilities not covered by the Program, must not exceed the statewide target. Thus for every ton of GHG emissions reductions accomplished by regulations, a smaller share of reductions required under the cap must be achieved through the Cap-and-Trade Program. For example, tailpipe GHG standards for new vehicles and the Low Carbon Fuel Standard result in reduced GHG emissions in the transportation sector, reducing the emissions reductions that will be required to be achieved by the Program. Determining the share of post-2020 emissions reductions that must be achieved by the Cap-and-Trade Program, therefore, requires generating forecasts of California GHG emissions that include potential reductions from anticipated post-2020 complementary policies.

For this report, the California GHG emissions forecast is based on results from the 2014 California State Agencies' PATHWAYS Project: Long-term Greenhouse Gas Reduction

¹⁰ <http://www.energy.ca.gov/2007publications/ARB-1000-2007-007/ARB-1000-2007-007.PDF>

Scenarios (PATHWAYS).¹¹ PATHWAYS is a California economy-wide, infrastructure-based GHG and cost analysis tool,¹² designed by Energy & Environmental Economics with support from Lawrence Berkeley National Laboratory to evaluate the feasibility and costs of a range of post-2020 GHG reduction scenarios for California. PATHWAYS is currently being updated for the 2030 Target Scoping Plan to reflect more recent input data as well as an updated portfolio of climate change policies to reflect the 2030 GHG emissions target.

PATHWAYS forecasts California GHG emissions through 2030 under a variety of scenarios that differ in terms of the timing and type of technology that might be adopted in the future. All PATHWAYS scenarios rely on existing technologies and assume a continuation of current lifestyles and economic growth as projected by California economic, energy, and fuel demand forecasts. The source data for the PATHWAYS scenarios includes California Department of Finance population projections and the California Energy Commission's Integrated Energy Policy Report (IEPR) and Energy Demand Forecast.¹³

All PATHWAYS scenarios assume current GHG policies are continued through 2020 and then outline combinations of technologies that represent different post-2020 complementary policies that can be implemented to achieve GHG reductions in 2030. Common to all scenarios are technologies related to efficiency and conservation, fuel switching, decarbonizing electricity, and decarbonizing liquid and gaseous fuels. For this report, the Straight Line and Early Deployment scenarios are used to represent the implementation of potential post-2020 complementary policies.¹⁴ PATHWAYS scenarios do not include the Cap-and-Trade Program, therefore, these scenarios can provide information on reductions that may be achieved through other measures and the remaining emissions reductions that may be required to be achieved through the post-2020 Program. The Straight Line and Early Deployment scenarios represent policies that by 2030 will achieve:

1. Doubling of current energy efficiency goals and reduced vehicle miles traveled
2. Greater reliance on electricity in buildings and zero emission vehicles
3. Renewables account for 50-60 percent of annual energy use by 2030
4. Emphasis on the use of biofuels for liquid transportation fuels
5. Reduction in non-energy, non-CO₂ GHGs including F-gases, and emissions from agriculture

¹¹ The State agency collaborators on the project include California Air Resources Board, the California Independent System Operator, the California Public Utilities Commission, and the California Energy Commission.

¹² The PATHWAYS model, documentation, input data and results can be found at https://ethree.com/public_projects/energy_principals_study.php.

¹³ <http://www.arb.ca.gov/cc/scopingplan/meetings/1142016/technicalappendix.pdf>

¹⁴ https://ethree.com/documents/E3_Project_Overview_20150406.pdf

Currently, the only post-2020 policies in statute are those in SB 350 which require 50 percent of electricity generation from renewable sources and doubling the energy efficiency of buildings, all by 2030. The additional policies that are needed to reach the 2030 target will be determined through the 2030 Target Scoping Plan and other plans currently under development such as the Short Lived Climate Pollutant Plan, which outlines targets for methane, black carbon, and F-gases. As the post-2020 policy mix is under development, no policies outlined in this report should be taken as final. The policies analyzed in this report represent the best available approximation for the post-2020 climate change portfolio.

Table 2 presents the PATHWAYS emissions forecast through 2030 under two scenarios. The existing policies forecast includes all policies in place as of 2014 (the time of the PATHWAYS analysis). The additional complementary policies scenario includes the GHG emissions forecasts for the PATHWAYS Straight Line and Early Deployment scenario and represents the current approximation of emissions reductions that will be achieved through complementary regulations and measures, excluding the Cap-and-Trade Program, through 2030.

Table 2: PATHWAYS Emissions Forecasts (MMTCO_{2e})

	2020	2025	2030	Annual Average Growth
Existing Policies	419	416	398	-0.5%
Additional Complementary Policies	376-381	339-351	268-289	-3.0 to -3.7%

The PATHWAYS scenarios shown in Table 2 do not reach the statewide GHG target of a 40 percent reduction below 1990 levels by 2030. Based on these forecasts, reaching the 2030 target could require cumulative reductions of about 900 MMTCO_{2e} between 2021 and 2030. As estimated through the Straight Line and Early Deployment Scenarios, complementary policies could achieve approximately 700 to 800 MMTCO_{2e} of the reductions from 2021 to 2030. To reach the goal of 40 percent below 1990 levels, the Cap-and-Trade Program could be required to provide GHG reductions in the range of 100 to 200 MMTCO_{2e} from 2021 to 2030 (i.e., about 10 to 20 percent). This range is conditional on the emissions reductions that will be achieved through complementary policies and uncertainty related to technology development and deployment, legal challenges, and reduction mandates at the national level.

The lower the emissions reductions delivered by complementary policies, the greater the demand placed on the Cap-and-Trade Program to deliver emissions reductions. By motivating investments in emissions reductions that would not be undertaken in response to price alone, complementary policies reduce the demand for allowances, thereby lowering their market price. This effect is true regardless of whether individual complementary policies generate net savings or have positive per-ton abatement costs that exceed the allowance price. Therefore, the estimated range of emissions

reductions required under the Program translates to a range of allowance prices in the post-2020 Cap-and-Trade Program.¹⁵

4. Public Outreach and Input

ARB has requested input from stakeholders and the public regarding the Amended Regulation. In 2015 and 2016, ARB conducted six public workshops, which were webcast and made available by teleconference, on the Amended Regulation. Information regarding these workshops and any associated materials are posted on the ARB website and distributed through several public listservs that include over 1,000 recipients. ARB has also briefed the EJAC on the Amended Regulation and held informal meetings with stakeholders.

The public workshops at which ARB solicited comments and feedback from affected stakeholders regarding the amendments include:

- October 1, 2015: Public Workshop on Potential 2016 Amendments to the Cap-and-Trade Regulation and California Plan for 111(d) Compliance.
- October 28, 2015: Public Workshop to Discuss the Potential for Including International Sector-Based Offset Credits in the Cap-and-Trade Program.
- December 14, 2015: Public Workshop on California Plan for Compliance with the Clean Power Plan and Potential 2016 Amendments to the Cap-and-Trade Program.
- February 24, 2016: Public Workshop on Potential Revisions to ARB's Regulation for the Mandatory Reporting of Greenhouse Gas Emissions and Cap-and-Trade Regulations.
- March 22, 2016: Public Workshop on Sector-Based Offsets.
- March 29, 2016: Public Workshop on Post-2020 Cap Setting and Allowance Allocation.
- April 5, 2016: Public Workshop on Cost Containment and Sector-Based Offsets.

In addition to continued efforts to solicit feedback from stakeholders about alternatives to the Amended Regulation, a formal solicitation was made at the February 24, 2016 public workshop for stakeholders to provide regulatory alternatives for this SRIA analysis. As this is also a proposed set of amendments to an existing program, several alternatives were proposed in the original Cap-and-Trade Program rulemaking in 2010 and subsequent amendments as well as during the development of the initial Scoping Plan in 2008.

¹⁵ http://www.arb.ca.gov/cc/scopingplan/economics-sp/updated-analysis/updated_sp_analysis.pdf

B. Benefits

While this report does not attempt to quantify the benefits of the Amended Regulation, the mitigation of the economic consequences of rising GHG emissions has been reinforced through the implementation of the Cap-and-Trade Program. The Program has been designed to support growth in activities that result in lower GHG emissions. Most benefits are an indirect result of the Program, and investments in energy efficiency and energy conservation can result in economic benefits to consumers and clean energy sectors.

1. Benefits to Individuals

There are no benefits directly introduced to individuals by the Proposed Amendment. However, to the extent that any portion of allowance value is returned indirectly to rate-payers, in a manner consistent with the current Regulation, individuals may also benefit from the Proposed Amendment. Individuals also may experience lower household expenditures driven by greater energy efficiency and clean technology innovations and additional economic benefits from any direct return of allowance value.

2. Benefits to Typical Businesses

Typical business may benefit from the financial incentive to develop lower-carbon technologies and manufacturing processes which could provide substantial expenditure reductions in the operations of many covered facilities. Businesses may also benefit through participation in the allowance market. Firms that trade allowances for profit, either through market participation or by reducing emissions and selling allocated allowances may see benefit from the Amended Regulation. In addition, emissions reductions achieved in sectors covered by the Program may also induce investment in energy efficiency by non-covered sectors, providing an indirect benefit to businesses.

3. Benefits to Small Businesses

There are likely no small businesses directly regulated by the Cap-and-Trade Program. However, small businesses could experience indirect economic benefits as a result of cost-savings attributed to the operation of energy efficient technologies. The Amended Regulation may also benefit small businesses that produce or sell low-carbon technologies and could result in the creation of new small businesses.

C. Direct Costs

1. Direct Costs on Individuals

The Amended Regulation will result in a direct cost to individuals through an increase in the price of goods based on their carbon content. Incorporating the cost of Cap-and-Trade Program allowances into the price of carbon-based fuels increases the price of fossil fuels and the price of products based on their use of fossil fuels. With complete

cost pass-through, for every \$10.00 of allowance price, the price of fossil fuels will increase by about the values displayed in Table 3. This cost will be directly faced by individuals purchasing these fuels in California and will also increase the delivered price of delivered goods and services to Californians.

Consumers may also substitute away from forms of transportation as well as goods and services that reflect a carbon price. This could include, for example, increased travel by air and water where feasible (as aviation and marine emissions are excluded from the Program) as other forms of transportation increase in cost. In this way, substitution could reduce the direct costs of the Amended Regulation on individuals.

Table 3
Price Increase for \$10 Allowance Cost
Assuming Complete Cost Pass-Through

Gasoline	\$0.09	Gallon
Diesel	\$0.10	Gallon
Electricity	\$6.35	MWh
Natural Gas	\$0.05	Therm

2. Direct Costs on Typical Businesses

Businesses that are covered by the Cap-and Trade Program are required to acquire and surrender allowances and compliance offset credits (up to the 8 percent offset usage limit) equal to their annual emissions. Based on reported emissions for 2014, the Cap-and-Trade Program covers about 440 individual facilities across 18 different 2-digit NAICS codes.¹⁶ The sectors that have the largest obligations include wholesale trade (transportation fuel provider), electric power generation, transmission and distribution, petroleum and coal products manufacturing, natural gas distribution, oil and gas extraction, and cement and concrete product manufacturing. Table 4 outlines the emissions obligation by NAICS code for facilities covered in 2014 by the Program. Businesses in California will face costs associated with acquiring and surrendering compliance instruments (allowances and offset) to satisfy their emissions obligation.

¹⁶ <https://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2014-ghg-emissions-2015-11-04.xlsx>

Table 4: Covered Facilities by 2-Digit NAICS

2-Digit NAICS	NAICS Description	Number of Covered Facilities	2014 Emissions Obligation (MMTCO_{2e})
11	Agriculture, Forestry, Fishing and Hunting	3	151,262
21	Mining, Quarrying, and Oil and Gas Extraction	39	18,524,736
22	Utilities	197	98,135,880
31-33	Manufacturing	129	81,775,052
42	Wholesale Trade	25	116,668,837
44-45	Retail Trade	6	2,582,589
48-49	Transportation and Warehousing	16	21,841,443
52	Finance and Insurance	5	1,648,143
54	Professional, Scientific, and Technical Services	2	58,037
55	Management of Companies and Enterprises	1	115,329
56	Administrative and Support and Waste Management and Remediation Services	3	262,349
61	Educational Services	11	845,973
62	Health Care and Social Assistance	1	61,686
92	Public Administration	3	138,057
	Total	441	342,809,374

Like individuals, non-covered production entities (i.e., those sectors not represented in Table 4) might have to pay more for fossil fuels and the cost of other input goods could be greater due to higher fossil fuel costs.

3. Direct Costs on Small Businesses

Based on the entities already subject to the Cap-and-Trade Regulation, no small businesses would face a compliance obligation under the Amended Regulation.¹⁷ Small businesses will be indirectly affected by the Cap-and-Trade Program due to the increased price of fossil fuels. Costs will vary based on the sector's use of fossil fuels and their ability to reduce the use of fossil fuels in the production process.

D. Macroeconomic Impacts

1. Methods for determining economic impacts

Regional Economic Models, Inc. (REMI), Policy Insight Plus Version 1.7.2 is used to estimate the macroeconomic economic impacts of the Proposed Amendment on the California economy. REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.

¹⁷ http://www.arb.ca.gov/cc/capandtrade/citss_registrants_123115.pdf

REMI Policy Insight Plus provides year-by-year estimates of the total impacts of the Amended Regulation, pursuant to the requirements of SB 617 and the California Department of Finance.¹⁸ ARB uses the REMI single-region, 160-sector model with the model Reference case adjusted to reflect the Department of Finance Conforming Forecast dated June 2015.

The Amended Regulation is simulated in REMI by adjusting production costs for covered sectors to reflect the purchase of Cap-and-Trade Program allowances, the distribution of free allowances, and the transfer of proceeds from the quarterly auction of allowances to sectors that have been identified to receive legislative appropriation of these funds. Based on reported emissions for 2014, the Cap-and-Trade Program covers about 45 different 2 to 4 digit NAICS sectors in the REMI model. ARB recognizes that modeling the Amended Regulation in REMI through changes in production costs for covered entities and modifications to consumption and state spending (reflecting investment of auction proceeds) may not capture the full impact of the Program. For example, compliance obligations are modeled as an increase in production costs while allowance allocation is modeled as a decrease in production costs. Therefore, the potential economic value related to implementing low-cost emission reductions and the selling of allocated allowances is not captured in the analysis.

To best reflect the interaction of economic variables using REMI, ARB has employed the production cost variable to emulate the net emissions obligation of covered entities, the consumer spending and consumption variables to mimic incentive programs used to purchase energy efficient appliances and cleaner car technologies, and the State and local spending variables to simulate the impact of Cap-and-Trade Program auction proceeds directed to programs that reduce GHG emissions and bring additional co-benefits to the State.

2. Inputs of the assessment

Based on the 2030 GHG emissions target, the potential Program annual cap for 2030 is estimated to be from about 203 to 216 MMTCO_{2e}.¹⁹ For the purpose of this analysis the cap represents a linear reduction from the 2020 allowance budget of 334.2 million allowances to a target of 210 million allowances in 2030, a decline of about 4.5 percent per year. The Amended Regulation would be required to achieve emissions reductions to fill the gap between reductions achieved through complementary measures and the cap.

The analysis is based on a range of prices that are intended to bound the possible allowances prices that may be observed under the Amended Regulation. A large number of factors influence the allowance price including the ease of substitution by firms to low-carbon production methods, consumer price response, and the pace of technological progress. A number of policy factors also impact the allowance price

¹⁸ More information is available on the California Department of Finance website at: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/view.php.

¹⁹ https://www.arb.ca.gov/cc/capandtrade/meetings/100215/ct_2016_amendments_kickoff.pdf

including methods for allocating allowances, the use of auction proceeds, and linkage with other jurisdictions, as well as factors such as the cost of GHG emission reduction technology, and potential impacts to the price of fuel.

Given the uncertainties about the nature of these factors, it is impossible to predict with precision the allowance price. The best that can be done is to estimate the price based on reasonable estimates of technological opportunities and behavioral responses under various conditions.

In 2010, ARB conducted a joint analysis of the AB 32 Climate Change Scoping Plan with Charles River Associates and Professor David Roland-Holst of the University of California Berkeley. The estimated allowance price in these analyses ranged from about \$20 MTCO_{2e} to \$100 MTCO_{2e} in 2020, depending on the emissions reductions achieved through complementary policies and the use of offsets.²⁰

In the 2010 ISOR of the Cap-and-Trade Regulation, ARB determined that the emissions reductions required by the Program would likely be achieved at an allowance price ranging from \$15 MTCO_{2e} to \$30 MTCO_{2e} in 2020.²¹ The 2010 ISOR then analyzed the economic impact of the Regulation across a range of allowance prices, bounded by the auction floor price (the minimum sales price for an allowance purchased through the quarterly auction) to the top tier price of the Allowance Price Containment Reserve (APCR). The APCR is a cost-containment mechanism, which includes a set-aside pool of allowances that can only be purchased by covered entities at prices set at three different tiers.²²

Similar to the 2010 economic analysis of the Regulation, this analysis includes a range of allowance prices bounded by the current Program's auction floor price, \$12.10 in 2015, and an extension of the top tier price of the APCR, \$56.51 in 2015. Results are also presented for an allowance price that is twice the auction floor price to provide insight on model results within the range of prices. As outlined in the current Regulation, the auction floor price and the top tier price of the APCR grow at a real rate of 5 percent per year in this analysis. The allowance prices utilized in the analysis are presented in Table 5.

For the purpose of this analysis, the industrial sector emissions are held constant at their 2014 reported emissions level assuming that any efficiency improvements are offset by growth in the sector between now and 2030. Emissions reductions required to meet the cap are assumed to come from the electricity, natural gas and transportation sectors. This is consistent with the Compliance Pathways Analysis conducted for the 2010 Cap-and-Trade Regulation.²³ Additional analysis related to the potential for

²⁰ Presentations on the analyses are available at:

<http://www.arb.ca.gov/cc/scopingplan/economicssp/meetings/042110/outline.pdf>

²¹ <http://www.arb.ca.gov/regact/2010/capandtrade10/capv4appn.pdf>

²² <http://www.arb.ca.gov/regact/2010/capandtrade10/capv3appg.pdf>

²³ <http://www.arb.ca.gov/regact/2010/capandtrade10/capv3appf.pdf>

emissions reductions by sector will be included in the ISOR for the Proposed Amendment.

Table 5: Cap-and-Trade Price Analyzed in REMI (2015 Dollars)

	2015	2020	2025	2030
Auction floor price	\$12.10	\$15.54	\$19.95	\$25.62
Auction floor price x 2	\$24.20	\$31.08	\$39.90	\$51.24
Third Tier APCR Price	\$56.51	\$72.12	\$92.05	\$117.48

Table 6 presents the estimated annual obligation of covered sectors included in the analysis at the auction floor price and using 2014 emissions obligations. The total value of all allowances is also included in Table 6.

**Table 6: Obligation by Sector at Auction Floor Price
(Millions 2015 Dollars)**

2-Digit NAICS		2021	2025	2030
11	Agriculture, Forestry, Fishing and Hunting	\$2.3	\$2.3	\$2.3
21	Mining, Quarrying, and Oil and Gas Extraction	\$279.5	\$282.2	\$285.5
22	Utilities	\$1,480.9	\$1,494.7	\$1,512.2
31-33	Manufacturing	\$1,234.0	\$1,245.5	\$1,260.1
42	Wholesale Trade	\$1,760.6	\$1,777.0	\$1,797.8
44-45	Retail Trade	\$39.0	\$39.3	\$39.8
48-49	Transportation and Warehousing	\$329.6	\$332.7	\$336.6
52	Finance and Insurance	\$24.9	\$25.1	\$25.4
54	Professional, Scientific, and Technical Services	\$0.9	\$0.9	\$0.9
55	Management of Companies and Enterprises	\$1.7	\$1.8	\$1.8
56	Administrative and Support and Waste Management and Remediation Services	\$4.0	\$4.0	\$4.0
61	Educational Services	\$12.8	\$12.9	\$13.0
62	Health Care and Social Assistance	\$0.9	\$0.9	\$1.0
92	Public Administration	\$2.1	\$2.1	\$2.1
	Total Allowance Value	\$5,173.1	\$5,221.5	\$5,282.6

The total allowance value is assumed to be returned to the economy in a manner consistent with the current Regulation.

A portion of the allowance value goes to industry to reflect industrial allocation to producing entities. Under the current Regulation, energy intensive trade exposed industries receive allocations to help them transition to the Cap-and-Trade Program and to address potential leakage concerns. Over time, allowances provided for transition assistance are meant to decline, while the allocation of allowances for leakage prevention may persist until there is a universal carbon price for that sector.

The cap adjustment factor for allowance allocation, one of the variables used to quantify the number of allowances a regulated entity will receive, declines at a rate of four percent per year over 2021-2030.²⁴ Table 7 provides the current third compliance period assistance factors (2018-2020) and estimated assistance factors for 2021-2030. The 2021-2030 assistance factors included in Table 7 are intended to be conservative and may not reflect what is proposed in the final Amended Regulation. For this analysis, the assistance factors in Table 7 are used to reduce production costs for covered sectors that receive allocation.

Table 7: Conservatively Assumed Transition Assistance Factors

Leakage Risk	2018-2020	2021-2022	2023-2024	2025-2027	2028-2029, and Subsequent years
High	100%	100%	100%	100%	100%
Medium	75%	50%	50%	30%	30%
Low	50%	30%	30%	10%	10%

Currently, the auction value associated with the auction of state-owned allowances is directed to the Greenhouse Gas Reduction Fund (GGRF) and must be used to further reduce GHG emissions. Types of projects include high-speed rail, intercity rail, energy efficiency and weatherization, wetlands and forest health and waste diversion.²⁵ In order to capture some of the effects of these projects, \$2 billion per year is directed to the REMI sectors indicated in Table 8. The sectors and the amounts of money directed are approximations made for this analysis. Decisions related to the redirection of allowance value have a considerable effect on the sectors receiving the value.

²⁴Table 9-2, http://www.arb.ca.gov/cc/capandtrade/capandtrade/unofficial_ct_030116.pdf

²⁵ Cap-and-Trade Auction Proceeds Second Investment Plan: Fiscal Years 2016-17 through 2018-19 <https://www.arb.ca.gov/cc/capandtrade/auctionproceeds/16-17-final-second-investment-planii.pdf>

**Table 8
Conceptual Distribution of GGRF Value**

Strategy	REMI Sector	Amount/Year
Sustainable Communities and Clean Transportation	Consumer New motor vehicles	\$250 Million
	Rail transportation	\$1 Billion
	Truck transportation	\$250 Million
Energy Efficiency and Clean Energy	Consumer Household maintenance	\$400 Million
	Water, sewage, and other systems	\$40 Million
Natural Resources and Waste	Forestry; Fishing, hunting, trapping	\$20 Million
	Waste management and remediation services	\$40 Million
Total per Year		\$2 Billion

Under the current Regulation, electric and gas utilities are provided allowances on behalf of their ratepayers.²⁶ For this analysis, the allowance value to the electric and natural gas utilities is returned directly to consumers with no specification on how the money is spent to approximate the use of this value for the benefit of rate-payers. For the purpose of this analysis, any remaining value is given to consumers to reflect possible future uses of allowance value such as dividends or reductions in other existing taxes.

The current Cap-and-Trade Regulation allows the limited use of offsets, which are reductions in uncapped sectors that follow protocols established by the Air Resources Board or one of its linked partners. For this analysis, it is assumed that all sectors fully utilize the established 8 percent offset limit. Realistically some of this value would stay in California for offsets originating in California; however, offsets are not a product that is represented in REMI so modeling this transaction realistically is difficult. Therefore, we have chosen to assume that all value related to the purchase of offset credits leaves the State economy.

3. Assumptions and Limitations of the Model

REMI is not an energy or emissions model, so it is not possible to estimate the emissions reductions that could be associated with a particular allowance price. ARB has utilized REMI's policy scenario tools to reflect, to best extent possible, the post-2020 Cap-and-Trade Program, without linking inputs to an external energy or emissions model. Emissions reductions estimates will be analyzed thoroughly in the ISOR associated with this Amended Regulation, and will be available after the release of this analysis.

²⁶ At this time, natural gas utilities can use a significant portion of the freely allocated allowances for direct compliance, staff is evaluating if the escalating rate for consignment should be increased to allow for 100 percent consignment sooner. This would result in the natural gas utilities being unable to use the freely allocated allowances for direct compliance sooner.

4. Results of the Assessment

a) California Employment Impacts

Table 9 presents the REMI results for total employment. All results are measured as the change from the reference case established in REMI with the Department of Finance conforming forecast dated June 2015. As the California economy is anticipated to grow through 2030 in the REMI baseline, negative impacts can be interpreted as a slowing of growth and positive impacts as an increase in the rate of growth. In Table 9, and all subsequent tables, the value in each year is interpreted as the incremental change in the referenced year between the baseline scenario and the policy scenario outlining the estimated impact of the Amended Regulation.

Depending on the industry, the model predicts small increases or decreases in employment. In the aggregate, the model predicts a small impact on overall employment in the State at the allowance prices analyzed. The slight increase in employment growth can be attributed to the recycling of allowance value both to covered entities, GGRF recipients, and consumers. However, over the entire timeframe of the analysis, the effects of increases in production cost outweigh the effect of the return of allowance value leaving growth in employment roughly unchanged relative to baseline scenario. In the model, the impacts at the state level are not greatly changed by how the money is returned within the State indicating that as long as the money remains in the state, the overall effects of the Program could be small relative to the size of the California economy.

Table 9: Total Employment

	2025	2030	2025	2030
	Absolute Change Thousands (Jobs)		Percent Change	
Auction floor price	18.2	15.3	0.1%	0.1%
Auction floor price x 2	20.0	9.9	0.1%	0.0%
Third Tier APCR Price	27.8	-1.5	0.1%	0.0%

b) California Business

Table 10 presents the estimated changes in 2030 to sector gross value added from the Amended Regulation. Gross value added is the contribution of each private industry and government to the State's gross domestic product. Estimated sector impacts to gross value added are both negative and positive and of small magnitude. Sectors with the greatest negative changes are those with large direct obligations such as utilities, mining, manufacturing, wholesale trade and transportation and warehousing. Sectors with the greatest positive changes are those that benefit from the return of allowance value, such as transportation and warehousing, which receive GGRF funds or the service sectors, which receive revenue indirectly from increased consumer spending.

In the reference scenario, the rate of average annual growth in gross value added across sectors is 2 percent. The impact of the Amended Regulation on gross value added ranges from 4 percent of annual growth at the auction floor price to 40 percent of annual growth at the third tier APCR price, as averaged across all sectors.

**Table 10: 2030 Sector Impacts Gross Value Added
Percent Change from Reference Case**

Category	Auction floor price	Auction floor price x 2	Third Tier Reserve Price
Forestry, Fishing, and Related Activities	0.2%	0.2%	0.1%
Mining	-1.1%	-2.2%	-5.3%
Utilities	-1.2%	-2.5%	-5.6%
Construction	0.0%	-0.3%	-0.9%
Manufacturing	-0.1%	-0.3%	-0.7%
Wholesale Trade	-0.1%	-0.3%	-0.8%
Retail Trade	0.0%	0.0%	0.0%
Transportation and Warehousing	0.8%	0.5%	0.0%
Information	0.0%	0.0%	0.1%
Finance and Insurance	0.1%	0.1%	0.3%
Real Estate and Rental and Leasing	0.0%	0.0%	0.1%
Professional, Scientific, and Technical Services	0.0%	0.0%	-0.1%
Management of Companies and Enterprises	0.0%	-0.1%	-0.2%
Administrative and Waste Management Services	0.1%	0.1%	0.1%
Educational Services	0.1%	0.2%	0.4%
Health Care and Social Assistance	0.1%	0.2%	0.4%
Arts, Entertainment, and Recreation	0.1%	0.1%	0.3%
Accommodation and Food Services	0.0%	0.1%	0.1%
Other Services, except Public Administration	0.3%	0.4%	0.7%

c) Impacts on Investments in California

Table 11 shows the impact on gross private domestic investment in California. Private investment consists of purchases of residential and nonresidential structures and of equipment and software by private businesses and nonprofit institutions. Results from REMI, show that the proposed regulation would have small impacts on California private investment.

In the Reference case gross private domestic investment grows at an annual rate of 3.81 percent. At the auction floor price, the annual rate of growth is basically unchanged while at the third tier APCR price the rate is reduced slightly to 3.75 percent.

Table 11: Gross Private Domestic Investment

	2025	2030	2025	2030
	Absolute Change (Billions \$2015)		Percent Change	
Auction floor price	-0.1	0.0	0.0%	0.0%
Auction floor price x 2	-1.2	-1.5	-0.2%	-0.2%
Third Tier APCR Price	-3.9	-5.2	-0.7%	-0.8%

d) Impacts on Individuals in California

The modeled results show that there could be a slight decrease in the growth of personal income and personal consumption across all consumer categories as a result of the Amended Regulation. Personal income includes income received from participation in production as well as from government and business transfer payments. In the baseline case, personal income grows at an annual rate of 4.84 percent while at the Auction floor price the annual rate of growth is reduced slightly to 4.83 percent.

Table 12: Personal Income

	2025	2030	2025	2030
	Absolute Change (Billions \$2015)		Percent Change	
Auction floor price	0.6	0.5	0.0%	0.0%
Auction floor price x 2	0.0	-1.0	0.0%	0.0%
Third Tier APCR Price	-1.3	-4.8	-0.1%	-0.2%

Table 13 presents the results in 2030 for impacts of the Amended Regulation on personal consumption. Personal consumption represents the value of goods and services purchased by individuals. Personal consumption declines are the greatest for consumer categories that include goods covered by the Program such as household utilities, motor vehicle fuels, lubricants, and fluids, and fuel oil and other fuels. Motor vehicles and parts and furnishings and durable household equipment sectors are affected by the use of allowance value to support vehicle and household energy efficiency, but the impacts are very small.

**Table 13: Personal Consumption in 2030
Percent Change from Reference Case**

	Auction floor price	Auction floor price x 2	Third Tier Reserve Price
Motor vehicles and parts	0.3%	0.3%	0.3%
Furnishings and durable household equipment	0.1%	0.2%	0.4%
Recreational goods and vehicles and other durable goods	0.1%	0.1%	0.3%
Food and beverages purchased for off-premises consumption	0.0%	0.0%	0.0%
Clothing and footwear	0.0%	0.0%	0.1%
Motor vehicle fuels, lubricants, and fluids	-0.2%	-0.5%	-1.2%
Fuel oil and other fuels	-0.2%	-0.4%	-1.0%
Other nondurable goods	0.1%	0.1%	0.3%
Housing	0.1%	0.1%	0.2%
Household utilities	-0.6%	-1.3%	-3.0%
Transportation services	0.2%	0.4%	1.0%
Health care	0.1%	0.2%	0.4%
Recreation and other services	0.2%	0.3%	0.7%

e) Impacts on Gross State Product (GSP)

Table 14 presents the modeled REMI results for State Gross Domestic Product (GSP). GSP is the market value of goods and services produced in California. Impacts on California GSP are small relative to the size of the California economy across the allowance prices analyzed. In the baseline scenario, gross domestic product grows at an annual rate of 4.14 percent while under the impact of the policy scenario using the Auction Floor Price, growth in GSP is reduced slightly to 4.11 percent annually.

Table 14: Gross State Product

	2025	2030	2025	2030
	Absolute Change (Billions \$2015)		Percent Change	
Auction floor price	\$0.6	\$0.3	0.0%	0.0%
Auction floor price x 2	-\$0.5	-\$2.0	0.0%	-0.1%
Third Tier APCR Price	-\$2.9	-\$7.6	-0.1%	-0.2%

f) Incentives for Innovation

The Amended Regulation may offer some additional incentives for innovation in low carbon technology above what is provided by the complementary policies. The declining cap overtime will require Cap-and-Trade Program covered entities to reduce emissions. The carbon price sends a signal for research, development, and deployment of

innovative technologies and fuels that can support long-term GHG emissions reductions while production and the economy continue to grow. The carbon price may also lead to existing covered entities to evolve from the production of traditional fuels to the production of the lower carbon fuels.

g) Competitive Advantage or Disadvantage

Allocation of allowances to covered sectors is meant to minimize the potential for competitive disadvantage for California businesses. In the short-term, this design feature of the Program should mitigate some competitive disadvantages for businesses in California as similar businesses outside California currently do not face a carbon price. However, due to the recent 2015 agreement reached by the Conference of Parties in Paris, aimed keeping the global temperature rise below 2°C, we can expect the US and other signatories to start to take action to reduce GHG emissions. As these policies come online, businesses outside of the state will begin to face similar carbon costs in order to reduce GHGs, reducing the relative impact of the Amended Regulation on California businesses.

h) Creation or Elimination of Businesses

The Proposed Amendment may lead to the elimination of some businesses in California as similar businesses outside California do not currently have to account for carbon costs. However, allocation to covered sectors is meant to minimize the potential for business elimination in California. The Proposed Amendment may also lead to the creation of businesses that produce or sell low-carbon technologies or other market related businesses such offset providers and verifiers. However, due to the recent 2015 agreement reached by the Conference of Parties in Paris, which is aimed keeping the global temperature rise below 2°C, we can expect the US and other signatories to start to take action to reduce GHG emissions. Increased global carbon pricing may mitigate the impact of the Amended Regulation on the creation and elimination of business in California.

5. Summary and Agency Interpretation of the Results of the Economic Impact Assessment

At any of the analyzed allowance prices, the Amended Regulation will have a small impact on the California economy. These results are highly dependent on the assumptions made regarding the return of allowance value. Additionally, the range of prices analyzed is based on emissions reductions that result from complementary policies, the cost of which are not considered in this analysis. Should complementary policies deliver fewer reductions than expected, the Cap-and-Trade Program allowance price could exceed the range of prices analyzed. If complementary policies deliver more reductions than are anticipated, fewer allowances may be purchased at auction as emissions obligations would decline, potentially reducing the overall cost of the Amended Regulation.

E. Alternatives

In addition to the Amended Regulation, ARB evaluated alternatives combining comments from stakeholders and staff analysis of feasible alternative. Alternative 1 focuses on prescriptive requirements for each sector. This includes requiring more onsite reductions or reduced production activity, resulting in reduced compliance flexibility and higher compliance costs to achieve the 2030 target. Alternative 2 considers a carbon fee set at the Social Cost of Carbon and includes a similar level of compliance flexibility as the Amended Regulation. Alternative 2 does not ensure the state achieves the 2030 target. Neither alternative would support any type of jurisdictional linkage as currently exists between California and Québec, and as is proposed with Ontario.

1. First Alternative: Facility Specific Requirements

In this alternative, it is assumed that post-2020 complementary policies achieve anticipated emissions reductions. To ensure the State achieves the 2030 target under Alternative 1, the gap in emissions reductions between the target and the reductions achieved through complementary policies must be achieved through direct facility-specific regulations. Alternative 1 requires that all covered entities achieve onsite emissions reductions from a historical baseline level to 40 percent below that level by 2030 with interim targets.

Under the Alternative 1, there would be no trading of “excess reductions”, in which an entity that exceeds the reduction target can sell excess reductions to another entity, or the use of offsets. While flexibility still remains for each entity to decide how best to reduce emissions, Alternative 1 would eliminate any trading and would force emission reductions at a consistent rate over interim compliance periods. For large sectors, onsite emissions reductions could potentially be achieved through fuel switching and electrification of boilers. There is less potential to reduce process-related emissions for other sections, including the cement sector. This alternative incorporates concepts received from the Environmental Justice Advisory Committee regarding potential alternatives to the Cap-and-Trade Program

Additionally, under Alternative 1, reaching the statewide 2030 target may require greater stringency in existing complementary programs. This could include increasing the renewable electricity portfolio standard above the required 50 percent by 2030 and requiring a greater than currently required 10 percent reduction in the carbon intensity of transportation fuels in the Low Carbon Fuel Standard.

a) Costs (Total and Incremental)

In 2010, ARB analyzed potential industry compliance pathways for achieving emissions reductions from some of the covered sectors.²⁷ It is likely that most of the low-cost reductions identified in the compliance pathways analysis, such as boiler optimization,

²⁷ <https://www.arb.ca.gov/regact/2010/capandtrade10/capv3appf.pdf>

will have already been utilized prior to 2020 to achieve the 2020 GHG emissions target, leaving only higher cost strategies, such as electrification of industrial boilers or implementing carbon capture and storage. Table 15 presents estimates of the possible costs to some covered sectors of these higher cost reduction strategies. The average cost to achieve the required emissions reductions in 2030 would likely be higher than the costs of achieving the 2020 target and Alternative 1 is likely more costly than the Amended Regulation.

**Table 15
Compliance Pathways²⁸**

	Cost/ Ton	Mixed Strategy Reduction Scenario		Lowest-Cost Reduction Scenario	
		Reductions MTCO ₂ e	Total Cost (\$ Million)	Reductions MTCO ₂ e	Total Cost (\$ Million)
Upstream Oil and Gas			\$1,341.9		\$335.5
Carbon Capture and Storage	\$50	4,025.6	\$201.3	6,709.4	\$335.5
Electric Boilers	\$425	1,341.9	\$570.3		
Fuel Switching to biofuel	\$425	1,341.9	\$570.3		
Refinery			\$1,638.4		\$856.8
Carbon Capture and Storage	\$90	5,712.0	\$514.1	9,520.0	\$856.8
Electric Boilers	\$425	952.0	\$404.6		
Fuel Switching of refinery flue gas to biofuel	\$252	2,856.0	\$719.7		
Cement			\$348.4		\$127.6
Fuel switching to biofuel	\$196	1,109.3	\$217.6		\$0.0
Blended Cement	\$0.0	489.8	(\$0.0)	1,632.8	(\$0.0)
Insulating Kiln Lining	\$0.8	100.9	\$0.1	100.9	\$0.1
Carbon Capture and Storage	\$96.1	1,361.2	\$130.8	1,327.5	\$127.5
Total		19.3	\$3,328.7	19.3	\$1,319.9
		Cost per ton	\$173		\$68

²⁸ Mixed Strategy Reduction Scenario uses a combination of emissions reduction strategies to achieve the emissions goal. Lowest-Cost Reduction Scenario uses only the lowest cost reduction strategy and does not assume limits on carbon capture and storage. Carbon capture and storage information is based on EIA, Assumptions to the Annual Energy Outlook 2011. Cement improvements based on LBNL Energy Efficiency Improvements and Cost Saving Opportunities for Cement Making (2008). Electric Boiler based on 110,000 pounds of steam per hour boiler costing \$1.5M. Biomethane based on information received from SoCalGas in 2013.

b) Benefits (Total and Incremental)

The benefits of Alternative 1 would be similar to those of the Amended Regulation as the facility-specific regulations would result in achieving the 2030 GHG target.

c) Economic Impacts

At the range of compliance costs outlined above, Alternative 1 would likely result in increased costs to covered entities relative to the Amended Regulation.

d) Cost-Effectiveness

Alternative 1 would be a less cost effective alternative compared to the Amended Regulation as it does not allow for trading of “excess reductions” or the use of offsets. This results in an increased cost of compliance for covered entities. The efficiency gains and benefits of trading in market-based programs has been well documented.²⁹ It is anticipated that Alternative 1 would be less cost-effective relative to the Amended Regulation.

e) Reason for Rejecting

Alternative 1 could sufficiently meet the environmental goals of the Amended Regulation but at a higher cost to California business and individuals relative to the Amended Regulation. Therefore, Alternative 1 is not a viable alternative to the Amended Regulation.

2. Second Alternative: Carbon Fee

Alternative 2 represents a fee-and-dividend approach to achieving the 2030 GHG target. This alternative includes a fixed cost for allowances, which are priced at the US EPA social cost of carbon of \$36 in 2015, increasing to \$50 in 2030 (these values are in 2007 dollars and translate roughly to \$48 to \$57 in 2015 dollars).³⁰ In Alternative 2, all auction proceeds are fully returned to California consumers. This alternative incorporates concepts received from the Environmental Justice Advisory Committee regarding potential alternatives to the Cap-and-Trade Program and simulates the impact of a carbon fee on the California economy.

²⁹ The extensive literature includes a 2010 report by ARB’s Economic and Allocation Advisory Committee (EAAC) in which EAAC outlines the benefits of trading in discussing options for allowance allocation in the Cap-and-Trade Program. The report is available at:

http://www.climatechange.ca.gov/eaac/documents/eaac_reports/2010-03-22_EAAC_Allocation_Report_Final.pdf.

³⁰ <http://www3.epa.gov/climatechange/Downloads/EPAactivities/social-cost-carbon.pdf>

a) Costs (Total and Incremental)

For the purpose of this cost estimation it is assumed that a fee established at the social cost of carbon exactly meets the reduction path established in the Amended Regulation. In reality, identifying the price that results in the required GHG emissions reductions would be very difficult, and it is unlikely that the path of reductions over time would directly align with those of the Amended Regulation. Relative to the auction floor price, the compliance costs associated with Alternative 2 would be greater for all covered sectors through 2030.

**Table 16: Obligation by Sector
Social Cost of Carbon
(Millions 2012 Dollars)**

2-Digit NAICS		2021	2025	2030
11	Agriculture, Forestry, Fishing and Hunting	\$6.9	\$6.2	\$5.4
21	Mining, Quarrying, and Oil and Gas Extraction	\$845.2	\$763.4	\$667.2
22	Utilities	\$4,477.7	\$4,044.1	\$3,534.4
31-33	Manufacturing	\$3,731.2	\$3,369.9	\$2,945.2
42	Wholesale Trade	\$5,323.3	\$4,807.9	\$4,201.9
44-45	Retail Trade	\$117.8	\$106.4	\$93.0
48-49	Transportation and Warehousing	\$996.6	\$900.1	\$786.6
52	Finance and Insurance	\$75.2	\$67.9	\$59.4
54	Professional, Scientific, and Technical Services	\$2.6	\$2.4	\$2.1
55	Management of Companies and Enterprises	\$5.3	\$4.8	\$4.2
56	Administrative and Support and Waste Management and Remediation Services	\$12.0	\$10.8	\$9.4
61	Educational Services	\$38.6	\$34.9	\$30.5
62	Health Care and Social Assistance	\$2.8	\$2.5	\$2.2
92	Public Administration	\$6.3	\$5.7	\$5.0
		\$15,641.6	\$14,127.0	\$12,346.6

b) Benefits (Total and Incremental)

The environmental benefits of Alternative 2 may not be equivalent to those anticipated under the Amended Regulation. Under Alternative 2, there is no guarantee that the chosen price would be sufficient to achieve the required GHG emissions reductions to meet the 2030 target. Alternatively, if the chosen price results in greater emissions reductions than required, Alternative 2 could result in additional environmental benefits, but at an unnecessarily high cost to California.

c) Economic Impacts

The economic impacts of Alternative 2 are presented in Table 17. The price trajectory of the fee established at the social cost of carbon falls roughly between the auction floor price and the third tier APCR price trajectories. As would be expected, the impacts fall in-between is the impacts presented in Section 4 for the auction floor price and the third tier APCR price. However, the values in Table 17 assume that Alternative 2 achieves the same amount of emissions reductions as the Amended Regulation, which is highly unlikely. Additional analysis regarding the GHG emissions reductions potential at across a range of allowance prices will be conducted as part of the 2030 Target Scoping Plan as well as in the ISOR for the Amended Regulation. However, for the purpose of this analysis it is assumed that the price trajectory of Alternative 2 perfectly meets the 2030 target.

If the price trajectory in Alternative 2 is too low to generate the necessary reductions, the emissions of covered entities would increase. This could result in covered entities paying a greater total amount to cover their emissions obligation, and a greater economic impact relative to the Amended Regulation. If the price trajectory of the carbon fee in Alternative 2 is too high, then emissions reductions would exceed the 2030 target and economic impacts would be greater than necessary.

**Table 17: Alternative 2
Economic Impacts**

	2025	2030	2025	2030
	Absolute Change (Billions \$2015)		Percent Change	
Gross Domestic Product (Billions \$2015)	-4.3	-8.2	-0.1%	-0.2%
Personal Income (Billions \$2015)	-2.3	-5.4	-0.1%	-0.2%
Total Employment (Thousands Jobs)	1.7	-24.3	0.0%	-0.1%

d) Cost-Effectiveness

A carbon fee as outlined in Alternative 2 does not guarantee that the 2030 GHG emissions target will be achieved. However, if it is assumed that the social cost of carbon exactly delivers the required emissions reductions, then Alternative 2 and the Amended Regulation will have the same cost-effectiveness. However, it is highly unlikely that the fee outlined in Alternative 2 will result in the same emissions reductions as the Amended Regulation, which would result in a lower cost-effectiveness for Alternative 2.

e) Reason for Rejecting

ARB rejects this alternative because it would not ensure that California achieves the 2030 statewide GHG emissions target. Alternative 2 would also not support any type of jurisdictional linkage as is expected to continue under the Amended Regulation with Québec and any new linkages, as proposed with Ontario. Under Alternative 2, the

change in the California Program would erode the effectiveness of any linked program and add uncertainty to the ability of linked jurisdictions to meet their own GHG emissions targets. In addition, US EPA would most likely not approve any state measures plan for compliance with the Clean Power Plan that does not have a mechanism to limit mass emissions from the affected generating units.

F. Fiscal Impacts

1. Local government

Currently, some local government entities (e.g., local utilities) are regulated parties in the Program and would have a compliance obligation under the Amended Regulation. These local governments could face administrative costs as well as costs associated with obtaining and surrendering compliance instruments. There may be additional impacts based on the continuance and appropriation of GGRF funds that are directed to local government.

2. State Government

The Cap-and-Trade Program also covers some State government entities. Examples include several University of California and California State campuses. These entities would incur compliance costs under the Amended Regulation.

There could also be impacts to the State budget based on the continuance of GGRF fund that are directed to State government. Any changes to the 3rd compliance period allocation that provide for greater amounts of industrial assistance will also shift some allowance value that would have gone to the State for appropriation through the GGRF to the covered entities.

3. ARB

The Amended Regulation would have minimal impact on staffing resources, which could be accommodated through a redistribution of existing staff. The fiscal impact of the Amended Regulation for ARB is expected to be negligible.

4. Other state agencies

The Amended Regulation could potentially impact other state agencies based on the continuance of GGRF funds that might directed to other state agencies, however these impacts are unknown and unquantified.