

**APPENDIX C**

**STAFF REPORT: INITIAL STATEMENT OF REASONS**

**Proposed Amendments to the California Cap on Greenhouse Gas Emissions and  
Market-Based Compliance Mechanisms Regulation**

**Revised Standardized Regulatory Impact Assessment (SRIA)**

**State of California**

**AIR RESOURCES BOARD**

**Release Date: August 2, 2016**

## **APPENDIX C:**

### **Revised SRIA for the Proposed Amendments**

On April 1, 2016, ARB submitted a Standardized Regulatory Impact Assessment (SRIA) to the California Department of Finance (DOF) for the proposed amendments to the California Cap on Greenhouse Gas Emissions and Market-Based Compliance Mechanisms Regulation (Regulation or Cap-and-Trade Regulation). On May 9, 2016 ARB received a letter from DOF acknowledging this major regulation and commenting on the information presented in the SRIA. The original SRIA and supporting documents are posted on the DOF Major Regulations website.<sup>1</sup>

This analysis is an update to the April 1, 2016 SRIA that includes modifications that have been made to the proposed amendments to the Regulation since the original SRIA submittal, also and addresses DOF comments. This appendix presents the full revised SRIA, including the estimated direct impacts and macroeconomic impacts estimated using the Regional Economic Models, Inc. (REMI) model. A summary of the DOF comments on the original SRIA and the ARB responses to those comments are also provided.

#### **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 approximately 80 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 (EO B-30-15). Amendments that would take effect for the third compliance period (2018-2020) include 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, 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.

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<sup>1</sup>[http://www.dof.ca.gov/Forecasting/Economics/Major\\_Regulations/Major\\_Regulations\\_Table/](http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/Major_Regulations_Table/)

## *Background*

As required by Assembly Bill 32 (AB 32, Nuñez, Chapter 488, Statutes of 2006) in 2008, the first Scoping Plan (ARB 2008) laid out a comprehensive program to reduce California's GHG 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. As implemented, the Cap-and-Trade 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. AB 32 also requires the Scoping Plan to be updated at least once every five years, and the first Scoping Plan update (ARB 2014) was released in 2014. In 2015, Governor Brown issued EO B-30-15, which directs ARB to update the Scoping Plan, in collaboration with other State agencies, to establish the path for realizing the 2030 GHG emissions limit.

In response to the executive order, ARB began a process, in coordination with other state agencies, to update the Scoping Plan with a series of symposia and a kickoff workshop in summer and fall 2015.<sup>2</sup> ARB is currently coordinating with other state agencies, economic reviewers, and the Environmental Justice Advisory Committee (EJAC), and holding public workshops to complete the process of updating the Scoping Plan for final Board consideration in early 2017. 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. The Board will be asked to take action on the 2030 Target Scoping Plan Update prior to any final vote on the proposed amendments to the Cap-and-Trade Regulation.

California's Cap-and-Trade Regulation was adopted by ARB in October 2011, and the Regulation took effect on January 1, 2012. The first allowance auction 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 major sources of statewide GHG emissions, and it creates a strong economic incentive for investments in cleaner, more efficient technologies. Each entity covered by the Program has a compliance obligation

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<sup>2</sup> <http://www.arb.ca.gov/cc/scopingplan/scopingplan.htm>

that is set by its GHG emissions each year and each compliance period, and entities are required to meet that compliance obligation by acquiring and surrendering allowances in an amount equal to their compliance obligation. ARB creates allowances equal to the total amount of permissible emissions (i.e., the cap) over a given compliance period. One allowance equals one metric ton of carbon dioxide equivalent (using the 100-year global warming potentials). Fewer allowances are created each year, thus the annual cap declines, and overall emissions are reduced over time.

The first three compliance periods are either a 2-year or 3-year block of time in the Program: 2013-2014, 2015-2017, and 2018-2020. Multiyear compliance periods provide entities time to develop compliance responses when annual emissions vary due to drought, economic conditions, or other unique production conditions.

The Program is designed to achieve the most cost-effective statewide GHG emissions reductions. There are no individual or facility-specific emissions reduction requirements; rather, each regulated party must acquire and surrender compliance instruments in an amount equal to their total GHG emissions during each compliance period. Firms can also meet a portion of their compliance obligation by surrendering offset credits, which are compliance instruments that are derived from rigorously verified emissions reductions from projects outside the scope of the Program. Like allowances, each offset credit is equal to one metric ton of GHG emissions. Allowances are issued by ARB and distributed by free allocation and by sale at auction; offset credits are issued by ARB for emission reductions at qualifying offset projects. A market exists where allowances and offset credits may be sold and traded among Program participants. By virtue of being linked to the Québec Cap-and-Trade System, California entities can also use Québec issued allowances and offsets as all compliance instruments issued by both jurisdictions are fully fungible.

Firms covered by the Program have flexibility to develop their most cost-effective compliance strategy. They may find methods to reduce emissions at their own facilities, trade allowances with other firms, or purchase allowances at auction. Through these mechanisms, the Program leverages the power of the market to find the most cost-effective methods to reach California's environmental goals. The ability to auction and trade allowances establishes a price signal needed to drive long-term investment in cleaner fuels and more efficient use of energy, and affords those parties that are regulated by the Program the flexibility to seek out and implement the lowest-cost options to reduce emissions.

The Program is designed to accommodate regional trading programs. Since 2007, California has been a partner in the Western Climate Initiative, a collaborative effort by U.S. states and Canadian provinces to implement policies to combat climate change, including through the development of a regional cap-and-trade system. ARB works with WCI partners on implementation issues to ensure that rigorous and compatible systems are in place. This cooperation facilitates future Program linkage with other developing GHG reduction programs in the region.

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, and 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, and these amendments took effect in October 2013. The start date for linking the California and Québec Cap-and-Trade Programs was January 1, 2014.

In 2013, ARB proposed another set of amendments to the Regulation. The amendments extended transition assistance 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 Mine Methane Capture compliance offset protocol, updates to offset implementation and usage, refinement of resource shuffling provisions, and changes to the surrender order of compliance instruments. The Board approved these amendments in April 2014, and they took effect July 1, 2014.

In 2014, ARB staff proposed an additional two sets of Cap-and-Trade Regulation amendments. The first set of targeted 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. This first set of 2014 amendments was adopted by the Board in September 2014, and they took effect January 1, 2015. The second set of 2014 amendments modified the Regulation to include a new Rice Cultivation Compliance Offset Protocol and to update the United States Forest Compliance Offset Protocol to allow eligibility for projects in parts of Alaska. This second set of amendments was adopted by the Board in June 2015 and became effective November 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 from late 2015 through mid-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 September 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. 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 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 includes a methodology to inform potential changes to industrial allocation for a post-2020 Program based on the results of leakage studies made public in spring 2016. 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.”<sup>3</sup> 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.

As the post-2020 assistance factors have not yet been specified, this analysis does not include any free allocation of allowances from 2021 through 2031. However, ARB proposes to retain the same general approach as the existing Regulation to calculate allowance allocation in the post-2020 period and may propose post-2020 assistance factors in a 15-day comment period.

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 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.

For the post-2020 Program, amendments will include a proposed cumulative emissions cap for the years 2021 through 2030 for covered emissions sources. 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 continued jurisdictional linkage with Québec and Ontario, and changes to compliance periods in the Program to support compliance with the federal Clean Power Plan.

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<sup>3</sup> California Health and Safety Code Section 38505(j)

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 implementation and harmonization. The similar design features and minimum stringency requirements facilitate linkage among the California, Québec, and Ontario programs. In addition Senate Bill 1018 (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; and
- Does not impose liability on California.

In 2013, 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 the Regulation (ARB 2012) found that linking with Québec could cause the allowance price in California to remain unchanged or increase slightly. Observed allowances prices are in line with the 2012 projections as there has been no noticeable change in the price of allowances when the programs officially linked in January 2014 or with the first joint auction of allowances in December 2014. It is anticipated 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. Jurisdictional GHG Emissions Targets.**

Target Year	California	Québec	Ontario
2020	Equal to 1990	20% below 1990 <sup>4</sup>	15% below 1990 <sup>5</sup>
2030	40% below 1990	37.5% below 1990 <sup>6</sup>	37% below 1990 <sup>7</sup>

Additional 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 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 report (CAT 2010) concluded that climate change will affect virtually every sector of the State’s economy and most of California’s ecosystems. 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 levels 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.

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). 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).

Extreme weather events have also had severe impacts on transportation systems, energy supplies, and other industries in North America. For example, major hurricanes

<sup>4</sup> [http://www.mddelcc.gouv.qc.ca/communiqués\\_en/2009/c20091123-cibleges.htm](http://www.mddelcc.gouv.qc.ca/communiqués_en/2009/c20091123-cibleges.htm)

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

<sup>6</sup> <http://www.mddelcc.gouv.qc.ca/changementsclimatiques/consultations/cible2030/index-en.htm>

<sup>7</sup> <http://news.ontario.ca/ene/en/2015/05/ontario-first-province-in-canada-to-set-2030-greenhouse-gas-pollution-reduction-target.html>



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 (Edison Electric Institute 2005).

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) 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. In 2015, Governor Brown issued EO B-30-15 to set a goal of reducing GHG emissions to 40 percent below 1990 statewide levels by 2030.

## **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 minor economic impact on the statewide economy. 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.<sup>8</sup>

The initial Scoping Plan (ARB 2008) 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

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<sup>8</sup> <http://www.dof.ca.gov/Forecasting/Demographics/Projections/>

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 (Market Advisory Committee 2007). 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 Scenarios (PATHWAYS; Energy and Environmental Economics, Inc. 2015a).<sup>9</sup> PATHWAYS is a California economy-wide, infrastructure-based GHG and cost analysis tool, 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.

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.

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<sup>9</sup> 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.

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 range of potential post-2020 complementary policies (Energy and Environmental Economics, Inc. 2015b). PATHWAYS scenarios do not include the Cap-and-Trade Program, therefore, these scenarios 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-CO<sub>2</sub> GHGs including F-gases, and emissions from agriculture

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 Reduction Strategy, 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 approximations of California's 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.

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<sub>2</sub>e between 2021 and 2030. As estimated through the Straight Line and Early Deployment Scenarios, complementary policies could achieve approximately 700 to 800 MMTCO<sub>2</sub>e 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<sub>2</sub>e 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.

**Table 2. PATHWAYS Emissions Forecasts (MMTCO<sub>2</sub>e).**

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

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 occurs regardless of whether individual complementary policies generate net savings or have positive per-ton abatement costs that exceed the allowance price. 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.

#### **4. Public Outreach and Input**

ARB has requested input from stakeholders and the public regarding the amended Regulation. In 2015 and 2016, ARB conducted ten public workshops, which have been 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 listserves 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 2, 2015: Potential 2016 Amendments to the Cap-and-Trade Regulation and California Plan for 111(d) Compliance.
- October 28, 2015: Potential for Including International Sector-Based Offset Credits in the Cap-and-Trade Program.
- December 14, 2015: California Plan for Compliance with the Clean Power Plan and Potential 2016 Amendments to the Cap-and-Trade Program.
- February 24, 2016: Potential Revisions to ARB’s Regulation for the Mandatory Reporting of Greenhouse Gas Emissions and Cap-and-Trade Regulations.

- March 22, 2016: Sector-Based Offset Credits.
- March 29, 2016: Post-2020 Cap Setting and Allowance Allocation.
- April 5, 2016: Incorporation of Sector-Based Offsets and Cost Containment Provisions
- April 28, 2016: Linkage and Sector-Based Offset Credits
- May 18, 2016: Emissions Leakage Studies for Cap-and-Trade Program.
- June 24, 2016: Electricity and Natural Gas Sectors

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.

## **B. Benefits**

While this report does not attempt to quantify the benefits of the amended Regulation, the Cap-and-Trade Program has supported the mitigation of the economic consequences of rising GHG emissions. 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, as 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 in a manner consistent with the current Regulation, individuals may also benefit from the amended Regulation. 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 businesses 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 excess allowances, may also see benefits 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

Individuals are not directly covered by the Regulation but the amended Regulation will result in a 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 Energy Sources for Every \$10 Allowance Cost Assuming Complete Cost Pass-Through.**

Energy Source	Price Increase <sup>#</sup>
Gasoline	\$0.09 per gallon
Diesel	\$0.10 per gallon
Natural gas	\$0.05 per therm
Electricity	\$6.35 per megawatt-hour

<sup>#</sup>Assumptions about CO<sub>2</sub>e emissions:

Gasoline: 19.64 pounds CO<sub>2</sub>e/gallon

Diesel: 22.38 pounds CO<sub>2</sub>e/gallon

Natural Gas: 117 pounds CO<sub>2</sub>e/MMBtu

Electricity: 635 grams CO<sub>2</sub>e/kWh

## 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,<sup>10</sup> the Cap-and-Trade Program would cover about 450 individual facilities across industrial sectors with 18 different 2-digit North American Industry Classification (NAICS) codes. Table 4 shows the reported 2014 emissions for facilities covered in the Program by two-digit NAICS code. Businesses in California will face costs associated with acquiring and surrendering compliance instruments (allowances and offsets) to satisfy their emissions obligations, which are calculated based on reported GHG emissions. Based on 2014 emissions, the sectors that have the largest obligations include wholesale trade (transportation fuel provider), utilities (electric power generation, transmission and distribution), and manufacturing. Based on 2014 emissions and an allowance price equal to the Auction Reserve Price in 2021, a covered entity's obligation could range from about \$25,000 up to almost \$900 million.

**Table 4. 2014 Reported Emissions and Number of Covered Facilities by Economic Sector.**

NAICS Code	Sector	Number of Covered Facilities	2014 Reported Emissions (MMTCO <sub>2</sub> e)
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
	<b>Total</b>	<b>441</b>	<b>342,809,374</b>

<sup>10</sup> <http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2014-ghg-emissions-2015-11-04.xlsx>

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. 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**

Changes as a result of implementing the amended Regulation are reflected throughout the California economy. Regional Economic Models, Inc. (REMI), Policy Insight Plus Version 1.7.2 is used to estimate the macroeconomic economic impacts of the amended Regulation on the California economy (Regional Economic Models, Inc. 2015). REMI is a structural economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.

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.<sup>11</sup> 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 transfer of allowance value to households, and the transfer of allowance value 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 fully capture the impacts of the Program to all sectors but it is adequate for assessing impacts at the State level.

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

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<sup>11</sup> More information is available on the California Department of Finance website at: [http://www.dof.ca.gov/Forecasting/Economics/Major\\_Regulations/SB\\_617\\_Rulemaking\\_Documents/](http://www.dof.ca.gov/Forecasting/Economics/Major_Regulations/SB_617_Rulemaking_Documents/)



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<sub>2e</sub>.<sup>12</sup> Table 6-2 of the amended Regulation presents the 2021-2031 California GHG Allowances Budgets. The budgets decline from 320.9 MMTCO<sub>2e</sub> in 2020 to 193.8 in 2031 MMTCO<sub>2e</sub>. 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 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<sub>2e</sub> to \$100 MTCO<sub>2e</sub> in 2020, depending on the emissions reductions achieved through complementary policies and the use of offsets.<sup>13</sup>

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<sub>2e</sub> to \$30 MTCO<sub>2e</sub> in 2020 (ARB 2010a). The 2010 ISOR then analyzed the economic impact of the Regulation across a range of allowance prices, bounded by the Auction Reserve Price, also known as the Auction Reserve 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 included a set-aside pool of allowances that could only be purchased by covered entities at prices set at three different tiers (ARB 2010b).

<sup>12</sup> [http://www.arb.ca.gov/cc/capandtrade/meetings/100215/ct\\_2016\\_amendments\\_kickoff.pdf](http://www.arb.ca.gov/cc/capandtrade/meetings/100215/ct_2016_amendments_kickoff.pdf)

<sup>13</sup> Presentations on the analyses are available at: <http://www.arb.ca.gov/cc/scopingplan/economics-sp/meetings/042110/outline.pdf>

Similar to the 2010 economic analysis of the Regulation, this analysis includes a range of allowance prices bounded by the current Program’s Auction Reserve Price, \$12.10 in 2015, and the APCR price, \$56.51 in 2015. As outlined in the amended Regulation, the Auction Reserve Price grows at a real rate of 5 percent per year and the APCR is now a single tier with the price set at \$60 above the Auction Reserve Price. 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 (ARB 2010c).

**Table 5. Range of Allowance Prices Analyzed in REMI (2015 Dollars).**

<b>Allowance Price</b>	<b>2015</b>	<b>2021</b>	<b>2026</b>	<b>2031</b>
Auction Reserve Price	12.10	16.22	20.70	26.41
APCR Price	56.51	76.22	80.70	86.41

Table 6 presents the estimated annual obligation of covered sectors included in the analysis at the Auction Reserve Price (for the given year) and using 2014 emissions obligations. The total value of all allowances is also included in Table 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 allowance allocation to producing entities in the third compliance period. Under the current Regulation, entities operating in energy intensive trade exposed sectors 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.

**Table 6. Obligation by Sector for an Allowance Price Equal to the Auction Reserve Price (millions of 2015 dollars).**

<b>NAICS Code</b>	<b>Sector</b>	<b>2021</b>	<b>2026</b>	<b>2031</b>
11	Agriculture, Forestry, Fishing and Hunting	2.3	2.3	2.3
21	Mining, Quarrying, and Oil and Gas Extraction	281.2	284.4	276.6
22	Utilities	1,489.6	1,506.6	1,465.4
31-33	Manufacturing	1,241.2	1,255.4	1,221.1
42	Wholesale Trade	1,770.9	1,791.1	1,742.1
44-45	Retail Trade	39.2	39.6	38.6
48-49	Transportation and Warehousing	331.5	335.3	326.1
52	Finance and Insurance	25.0	25.3	24.6
54	Professional, Scientific, and Technical Services	0.9	0.9	0.9
55	Management of Companies and Enterprises	1.8	1.8	1.7
56	Administrative and Support and Waste Management and Remediation Services	4.0	4.0	3.9
61	Educational Services	12.8	13.0	12.6
62	Health Care and Social Assistance	0.9	0.9	0.9
92	Public Administration	2.1	2.1	2.1
	<b>Total Obligation</b>	<b>5,203.4</b>	<b>5,262.8</b>	<b>5,118.8</b>

Table 8-1 of the amended Regulation outlines the third compliance period assistance factors for the years 2018-2020. The assistance factors are used to estimate the amount of allocation that a sector may receive. As post-2020 assistance factors have not yet been specified, this analysis does not include any free allocation of allowances from 2021 through 2031. However, ARB proposes to retain the same general approach as the current Regulation to calculate allowance allocation in the post-2020 period and may propose assistance factors in a 15-day comment period.

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 funded by the GGRF include high-speed rail, intercity rail, energy efficiency and weatherization, wetlands and forest health and waste diversion (ARB 2016). In order to capture some of the effects of these projects, \$2 billion per year is directed to the REMI sectors indicated in Table 7. As the allowance value over time may vary, the total GGRF funds available each year as well as the distribution of monies are approximations made for this analysis. Decisions related to the redirection of allowance value have a considerable effect on the sectors receiving the value.

Under the current Regulation, electric and gas utilities are provided allowances on behalf of their ratepayers. For this analysis, the allowance value from the electric and natural gas utilities share of emissions 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. No allowance value is returned to electric and gas utilities for the post-2020 period. For the purpose of this analysis, any remaining value after the distribution of funds to utilities and \$2 billion GGRF funding is given to consumers to reflect possible future uses of allowance value such as dividends or reductions in other existing taxes.

**Table 7. Conceptual Distribution of GGRF Value by Sector.**

Strategy	REMI Sector	Value (\$/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, and trapping	20 Million
	Waste management and remediation services	40 Million
	<b>Total</b>	<b>2 Billion</b>

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 eight 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, this analysis conservatively assumes 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.

### 4. Results of the Assessment

#### *a. California Employment Impacts*

Table 8 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, estimated increases in production costs mitigate the effect of the return of allowance value leaving growth in employment roughly unchanged relative to the 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 would be small relative to the size of the California economy.

**Table 8. Change from the Reference Case in Total Employment.**

Allowance Price	Absolute Change (thousands of jobs)		Percent Change	
	2026	2031	2026	2031
Auction Reserve Price	16.7	12.6	0.1%	0.1%
APCR Price	7.9	-17.6	0.1%	0.0%

*b. California Business Impacts*

Directly covered facilities will be required to acquire and surrender compliance instruments equal to their annual reported and verified emissions; increasing their cost of production. The Program gives covered facilities the flexibility to either make emissions reductions or purchase allowances and a limited number of offset credits, minimizing their cost of compliance. All other consumers of fossil fuel products such as non-energy intensive industrials and most commercial businesses are not directly covered by the Program, but will pay higher prices for fossil fuels and products that use fossil fuels. The impact to indirectly covered entities will depend on their use of fossil fuels.

Table 9 presents the estimated changes to sector gross value added from the amended Regulation in the year 2030. 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.

**Table 9. Change from Reference Case in 2031 Gross Value Added by Sector.**

Sector	Absolute Change (billions \$2015)		Percent Change	
	Auction Reserve Price	APCR Price	Auction Reserve Price	APCR Price
Forestry, Fishing, and Related Activities	0.0	0.0	0.2%	0.1%
Mining	-0.6	-2.3	-2.1%	-7.6%
Utilities	-0.5	-1.8	-1.2%	-4.3%
Construction	-0.1	-1.3	-0.1%	-0.9%
Manufacturing	-1.0	-4.4	-0.2%	-0.9%
Wholesale Trade	-0.2	-1.2	-0.1%	-0.6%
Retail Trade	0.1	0.0	0.0%	0.0%
Transportation and Warehousing	0.6	0.1	0.8%	0.1%
Information	0.1	0.0	0.0%	0.0%
Finance and Insurance	0.2	0.4	0.1%	0.2%
Real Estate and Rental and Leasing	0.2	-0.1	0.0%	0.0%
Professional, Scientific, and Technical Services	0.0	-0.6	0.0%	-0.2%
Management of Companies and Enterprises	0.0	-0.1	0.0%	-0.2%
Administrative and Waste Management Services	0.1	0.0	0.1%	0.0%
Educational Services	0.0	0.1	0.1%	0.2%
Health Care and Social Assistance	0.2	0.6	0.1%	0.3%
Arts, Entertainment, and Recreation	0.0	0.1	0.1%	0.2%
Accommodation and Food Services	0.0	0.0	0.0%	0.0%
Other Services, except Public Administration	0.2	0.3	0.3%	0.6%
<b>Total</b>	<b>-0.8</b>	<b>-10.2</b>	<b>0.0%</b>	<b>-0.3%</b>

In the reference scenario, the rate of average annual growth in gross value added across sectors is 2.21 percent. The impact of the amended Regulation on gross value added ranges from 2.20 percent annual growth at the Auction Reserve Price to 2.14 percent annual growth at the APCR price, as averaged across all sectors.

*c. Impacts on Investments in California*

Table 10 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 Reserve Price the annual rate of growth is basically unchanged from the Reference case, while at the APCR price the rate is reduced slightly to 3.74 percent.

**Table 10. Change from the Reference Case in Gross Private Domestic Investment.**

Allowance Price	Absolute Change (billions \$2015)		Percent Change	
	2026	2031	2026	2031
Auction Reserve Price	-0.5	-0.6	-0.1%	-0.1%
APCR Price	-5.4	-6.0	-1.0%	-0.9%

*d. Impacts on Individuals in California*

Individuals are not directly covered by the amended Regulation but will face an increase in the price of goods based on their carbon content. Incorporating the cost of 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. Assuming complete cost pass-through, the impact to household electricity and natural gas consumption is presented in Table 11. Using 2014 price and consumption data evaluated at the 2021 Auction Reserve Price, the increase in an average household's annual expenditures for electricity and natural gas are about \$100.

**Table 11. Household Consumption Impacts at the 2021 Auction Reserve Price**

Energy Source	Total Annual Consumption <sup>1,2</sup>	Price Change	Total Expenditure Change	Individual Household Expenditure Change	Percent Change
Electricity	89,361 GWh	\$10.30 per MWh	\$920 million	\$69.4	6.3%
Natural Gas	407 Trillion BTU	\$0.86 per MMBTU	\$351 million	\$26.5	7.7%

1. U.S. Energy Information Agency EIA-826 monthly survey data was used for electricity consumption.<sup>14</sup>
2. U.S. Energy Information Agency Table F19 data was used for natural gas consumption.<sup>15</sup>

<sup>14</sup> <http://www.eia.gov/electricity/data.cfm#sales>

<sup>15</sup> [http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep\\_fuel/html/fuel\\_use\\_ng.html&sid=US](http://www.eia.gov/state/seds/data.cfm?incfile=/state/seds/sep_fuel/html/fuel_use_ng.html&sid=US)

The modeled results, presented in Table 12, 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 transfer payments from government and business. In the baseline case, personal income grows at an annual rate of 4.52 percent while at an allowance price equal to the APCR price the annual rate of growth is reduced slightly to 4.49 percent.

**Table 12. Change from the Reference Case in Personal Income.**

Allowance Price	Absolute Change (billions \$2015)		Percent Change	
	2026	2031	2026	2031
Auction Reserve Price	0.4	0.1	0.0%	0.0%
APCR Price	-3.2	-6.0	-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. Change from Reference Case in 2031 Personal Consumption.**

Category	Absolute Change (billions \$2015)		Percent Change	
	Auction Reserve Price	APCR Price	Auction Reserve Price	APCR Price
Motor vehicles and parts	0.3	0.3	0.3%	0.4%
Furnishings and durable household equipment	0.1	0.2	0.1%	0.3%
Recreational goods and vehicles and other durable goods	0.2	0.5	0.1%	0.3%
Food and beverages purchased for off-premises consumption	0.1	-0.1	0.0%	0.0%
Clothing and footwear	0.0	0.1	0.1%	0.1%
Motor vehicle fuels, lubricants, and fluids	-0.3	-1.0	-0.4%	-1.3%
Fuel oil and other fuels	0.0	0.0	-0.3%	-1.2%
Other nondurable goods	0.2	0.4	0.1%	0.2%
Housing	0.2	0.4	0.1%	0.1%
Household utilities	-0.3	-0.9	-0.6%	-2.0%
Transportation services	0.2	0.5	0.2%	0.7%
Health care	0.4	1.3	0.1%	0.3%
Recreation and other services	1.3	3.4	0.2%	0.5%
<b>Total</b>	<b>2.3</b>	<b>5.1</b>	<b>0.1%</b>	<b>0.2%</b>

*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 3.90 percent while under the impact of the policy scenario using the Auction Reserve Price, growth in GSP is reduced slightly to 3.87 percent annually.

**Table 14. Change from the Reference Case in Gross State Product.**

Allowance Price	Absolute Change (billions \$2015)		Percent Change	
	2026	2031	2026	2031
Auction Reserve Price	0.0	-0.5	0.0%	0.0%
APCR Price	-6.3	-9.8	-0.2%	-0.3%

*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 over time 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 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 Paris Agreement reached by the Conference of Parties in Paris (United Nations 2015), aimed at keeping the global temperature rise below 2°C, we can expect the U.S. 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 amended Regulation 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 emissions leakage and business elimination in California. The amended Regulation 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. The 2015 Paris Agreement under the United Nations Framework Convention on Climate Change (United Nations 2015) aims keeping the global temperature rise below 2 °C. The agreement is intended to motivate 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 alternatives. 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 that 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 sectors, 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 pathways for some industrial sectors to reduce emissions and achieve compliance (ARB 2010c). It is likely that most of the low-cost reductions identified in the compliance pathways analysis, such as boiler optimization, will have already been used prior to 2020, leaving only higher cost strategies, such as electrification of industrial boilers or implementing carbon capture and storage after 2020. 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. Cost-Effectiveness of Compliance Pathways<sup>16</sup> for Certain Sectors.**

Sectors and Strategies	Cost (\$/MTCO <sub>2</sub> e)	Mixed-Strategy Reduction Scenario		Lowest-Cost Reduction Scenario	
		Reductions (MMTCO <sub>2</sub> e)	Total Cost (\$ Million)	Reductions (MMTCO <sub>2</sub> e)	Total Cost (\$ Million)
<b>Upstream Oil and Gas</b>		<b>6.71</b>	<b>1,341.9</b>	<b>6.71</b>	<b>335.5</b>
Carbon Capture and Storage	50	4.03	201.3	6.71	335.5
Electric Boilers	425	1.34	570.3		
Fuel Switching to Biofuel	425	1.34	570.3		
<b>Refinery</b>		<b>9.52</b>	<b>1,638.4</b>	<b>9.52</b>	<b>856.8</b>
Carbon Capture and Storage	90	5.71	514.1	9.52	856.8
Electric Boilers	425	0.95	404.6		
Fuel Switching: Refinery Fuel Gas to Biofuel	252	2.86	719.7		
<b>Cement</b>		<b>3.06</b>	<b>348.4</b>	<b>3.06</b>	<b>127.6</b>
Fuel Switching to Biofuel	196	1.11	217.6		
Blended Cement	0	0.49	0.0	1.63	0.0
Insulating Kiln Lining	0.8	0.10	0.1	0.10	0.1
Carbon Capture and Storage	96.1	1.36	130.8	1.33	127.5
<b>Total</b>		<b>19.29</b>	<b>3,329</b>	<b>19.29</b>	<b>1,320</b>
<b>Cost (\$/MTCO<sub>2</sub>e)</b>		<b>\$173/MTCO<sub>2</sub>e</b>		<b>\$68/MTCO<sub>2</sub>e</b>	

<sup>16</sup> 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 is documented (Economic and Allocation Advisory Committee 2010). 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) (U.S. Environmental Protection Agency 2015). 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.

*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 Reserve

Price, the compliance costs associated with Alternative 2 would be greater for all covered sectors through 2030 as presented in Table 16.

**Table 16. Obligation by Sector for an Allowance Price Equal to the Social Cost of Carbon (millions of 2015 dollars).**

NAICS Code	Sector	2021	2026	2031
11	Agriculture, Forestry, Fishing, and Hunting	6.9	6.0	5.0
21	Mining, Quarrying, and Oil and Gas Extraction	847.8	734.7	609.6
22	Utilities	4,491.3	3,892.2	3,229.4
31-33	Manufacturing	3,742.5	3,243.3	2,691.0
42	Wholesale Trade	5,339.5	4,627.3	3,839.2
44-45	Retail Trade	118.2	102.4	85.0
48-49	Transportation and Warehousing	999.6	866.3	718.7
52	Finance and Insurance	75.4	65.4	54.2
54	Professional, Scientific, and Technical Services	2.7	2.3	1.9
55	Management of Companies and Enterprises	5.3	4.6	3.8
56	Administrative and Support and Waste Management and Remediation Services	12.0	10.4	8.6
61	Educational Services	38.7	33.6	27.8
62	Health Care and Social Assistance	2.8	2.4	2.0
92	Public Administration	6.3	5.5	4.5
	<b>Total Obligation</b>	<b>15,689.1</b>	<b>13,596.3</b>	<b>11,280.9</b>

*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 Reserve Price and the APCR price trajectories. As would be expected, the impacts fall in-between the impacts presented in Section 4 for the Auction Reserve Price and the 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 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. Economic Impacts Under a Carbon Fee.**

Measured Outcome	Absolute Change		Percent Change	
	2026	2031	2026	2031
Gross State Product (billions \$2015)	-5.6	-8.4	-0.2%	-0.2%
Personal Income (billions \$2015)	-3.3	-5.6	-0.1%	-0.2%
Total Employment (thousands of jobs)	-7.5	-26.2	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, U.S. 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. Municipal utilities and public universities currently receive an allocation of allowances so they do not have to cover the full cost of their emissions obligation. There may be additional impacts based on the continuance and appropriation of auction proceeds from the Greenhouse Gas Reduction Fund (GGRF) that are directed to local government.

Local government entities that purchase goods and fossil fuels in California but are not directly covered by the Regulation will face higher prices for fossil fuels and products that use 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. Local governments could also benefit from new lower carbon technologies and innovations that may be indirect benefits of the amended Regulation.

### 2. State Government

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

The effect on State agencies of the amended Regulation will not occur until FY 20-21. The estimated direct fiscal year impact to State Universities is presented in Table 18.

**Table 18. Estimated Direct Fiscal Year Costs to State University Systems.<sup>#</sup>**

University System	Estimated Annual Emissions (MTCO <sub>2</sub> e)	Estimated Annual Costs (\$)
University of California	624,133	10,123,437
California State University	165,529	2,684,880

<sup>#</sup> Assumes compliance through the purchase of allowances at the 2021 Auction Reserve Price, based on 2014 reported emissions.

State entities that purchase goods and fossil fuels in California, but are not directly covered by the Regulation, will face higher prices for fossil fuels and products that use 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. State entities could potentially benefit from new lower-carbon technologies and innovations that may be indirect benefits of 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 allowance 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 covered entities, and vice versa.

### **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**

State entities that purchase goods and fossil fuels in California, but are not directly covered by the Regulation, will face higher prices for fossil fuels and products that use 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. State entities could potentially benefit from new lower-carbon technologies and innovations that may be indirect benefits of the amended Regulation.

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.

## **C. Summary of DOF Comments**

In comments addressing the SRIA of the proposed amendments to the Regulation, DOF generally concurred with the methodology and results of the SRIA. While the results of the assessment were sufficient to meet the requirements of CCR, Title I, Section 2002 (a)(1), some enhancements to the analysis were suggested by DOF to clarify the results. Specifically, DOF made three main suggestions for ARB to:

- Narrow the ranges of estimated impacts, if possible;
- Provide historical context to demonstrate how the current Cap-and-Trade Program has differed from initial expectations; and
- Translate results into specific impacts on individuals and businesses.

The comments provided by DOF have been considered in the revised SRIA which is included as an attachment to the ISOR. The comments provided by DOF and the ARB responses to those comments are also provided here.

### *DOF Comment #1*

The SRIA could be more specific about what impacts are expected rather than relying on a very large range in allowance value price. It is necessary to use a range of allowance values in this modeling assessment, as there will be uncertainty, but a smaller range would be helpful for the public in focusing their comments. In addition, future SRIAs for proposed regulations that affect the Cap-and-Trade Program should discuss how those regulations would affect the impacts discussed here.

### *ARB Response to DOF Comment #1*

A large number of factors influence the price of allowances in the Cap-and-Trade Program (Economic and Allocation Advisory Committee 2010). The technological and behavioral factors include the ease of switching to low-GHG methods of production, the extent to which consumers shift to low-GHG products in response to price changes, and the pace of technological progress. A number of policy factors also apply, including emissions reductions from complementary environmental policies. The amended Regulation will affect the cost of using energy derived from fossil fuels, which in turn will affect the price of most goods and services throughout the California economy. Some covered entities will make efficiency improvements that result in reduced fuel expenditures and reduced emissions. The increased price of energy will cause secondary emissions reductions by non-covered entities through increased energy efficiency, decreased purchases of energy-intensive goods and services, and increased conservation (e.g., driving less).

Since the Regulation does not specify how or where emissions reductions will occur, it is impossible to know in advance what covered or non-covered entities will do to comply, or how they will respond to the amended Regulation. Therefore, possible compliance responses, as observed through the estimated change in capital, labor, energy, and fuel expenditures, must be modeled across a wide range of carbon prices. In addition, the impacts of any future regulatory action on the amended Regulation will be discussed when appropriate in subsequent rulemakings.

### *DOF Comment #2*

The SRIA could provide some historical context about how results of the existing Cap-and-Trade Program differed from initial expectations, and where uncertainty still remains. This information would be helpful in drawing attention to areas where the public could provide additional information on new technologies, or weigh in on potential unintended consequences.

### *ARB Response to DOF Comment #2*

California's Cap-and-Trade Regulation was adopted by ARB in October 2011 and achieved full implementation in 2015 with the inclusion of transportation fuels under the cap. To date there have been two compliance deadlines in the Program, covering the

first compliance period, 2013 and 2014. While there are many ex ante estimates of the impact of the Cap-and-Trade Program, it is difficult to assess the realized impacts given the short implementation timeline thus far. Amendments to the Cap-and-Trade Regulation in 2012, 2013, and 2014 provided opportunities to modify the Program and address unanticipated impacts, including changes to the tracking system, allowance allocation, and cost containment provisions. ARB will continue to monitor the Program and make modifications as necessary.

*DOF Comment #3*

There are some areas where it is difficult to translate results into how individuals or businesses would be affected. For example, Tables 10 and Table 13 present percentage changes, but this information would be more relatable if presented in dollar amounts. Additional examples of how individuals and businesses could be affected would be helpful.

*ARB Response to DOF Comment #3*

The SRIA has been revised to address these concerns. Table 10 and Table 13 from the original SRIA have been modified to present the information in absolute dollar amounts (Table 9 and Table 13 in this revised SRIA), and additional detail has been added to the discussion regarding the impact to businesses and individuals.

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