APPENDIX E

SUMMARY OF DOF COMMENTS TO THE COMBINED LCFS/ADF SRIA AND ARB RESPONSES

INCLUDES COMBINED LCFS/ADF SRIA

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Appendix E: Summary of DOF Comments to the Combined LCFS/ADF SRIA and ARB Responses

ARB summarized the comments received from DOF on November 18, 2014. The original SRIA is located after the comment responses at the end of this Appendix.

1. DOF Comment: Because the proposed LCFS regulations were not attached, DOF was unable to determine whether all the estimated impacts in the SRIA occur as a result of the regulation were addressed.

Regulatory language can now be found in Appendix A of the ISOR. Additional information and analysis of the proposed regulations can be found in the included Initial Statement of Reasons (ISOR) for the Low Carbon Fuel Standard regulation at www.arb.ca.gov/regact/2015/lcfs2015/lcfs2015.htm and the Alternative Diesel Fuel regulation at www.arb.ca.gov/regact/2015/adf2015/adf2015.htm.

2. DOF Comment: The purchasers and sellers of the LCFS credits should be clearly stated.

All regulated parties have the ability to participate in the LCFS credit market by buying and selling credits. Fuel suppliers that produce and sell transportation fuels with carbon intensity values (CI) above that year's standard generate deficits and must retire sufficient credits to offset the deficits generated in order to demonstrate compliance; fuel suppliers that produce and sell transportation fuels with carbon intensity values (as adjusted for relative power train efficiencies) below that year's standard generate credits, which they can retire to meet their compliance obligation, bank, and/or sell in the LCFS credit market.

In general, the LCFS places compliance obligations initially on regulated parties that are upstream entities (i.e. producers and importers that are legally responsible for the quality of transportation fuels in California), rather than downstream distributors and fueling stations. However, under specified conditions, the regulated party may be another entity further downstream that can be held responsible for the CI of the fuels or blendstocks that they dispense in California. The proposed regulation specifies the criteria under which an entity would be deemed a regulated party for each particular fuel and how the responsibility for complying with the LCFS can be transferred. Table 1 summarizes the regulated parties for each transportation fuel.

The proposed regulation includes an opt-in provision, which explicitly recognizes that certain alternative fuels have full fuel-cycle CIs (as adjusted for relative power train efficiencies) that inherently meet the proposed compliance standards through 2020. As a result, these fuels may choose an opt-in provision. These fuels are:

- Electricity;
- Hydrogen and hydrogen blends;
- Fossil CNG derived from North American sources;

- Biogas CNG; and
- Biogas LNG.

Parties that opt into the LCFS program will be those parties that expect to generate LCFS credits under the regulation. By opting into the program, an entity becomes a regulated party under the LCFS regulation and is required to meet the LCFS reporting obligations and requirements.

The illustrative compliance scenario used for the ISOR economic analysis indicates the projected generation of credits and deficits by fuel types as seen in Appendix F in the ISOR.

Table 1 Transportation Fuel Regulated Parties Engaged in Selling and Buying LCFS Credits

Fuel	Description of Regulated Party
Gasoline, diesel, and liquid blendstocks (including oxygenates, biodiesel and renewable diesel)	The regulated party is the producer or importer of the fuel or blendstocks.
Fossil fuel-derived compressed natural gas (fossil CNG)	The regulated party is generally the utility company, energy service provider, or other entity that owns the fuel dispensing equipment.
Fossil fuel-derived liquefied natural gas (fossil LNG)	The regulated party is the entity that owns the fuel when it is transferred to the fuel dispensing equipment in California.
Other gaseous fuels (biogas/biomethane, hydrogen)	The regulated party will generally be the entity that produces the fuel and supplies it for vehicular use.
Electricity	The regulated party will be either the load service entity supplying the electricity to the vehicle or another party that has a mechanism to provide electricity to vehicles and has assumed the LCFS compliance obligation.

3. DOF Comment: From a modeling standpoint, because there will be offsetting price and quantity impacts, consumer spending variables in REMI would be a more appropriate means of addressing impacts than consumer price variables alone, as was done in the SRIA.

The offsetting price and quantity impacts are projections of the industry response to the regulation and are used as inputs to the macroeconomic model. DOF suggests that ARB use a different variable to represent the potential change in consumer spending that would result from the combined LCFS/ADF regulations. Using the consumer expenditures category, as suggested by DOF, would be interpreted in the model as a shift in the demand by consumers

and thus yield a higher quantity demanded. This would be counter to the expected impact of the LCFS, which should not increase demand for conventional fuels in California. The LCFS acts to reduce the amount of conventional fuels and replace them with lower carbon alternatives. Using the expenditure changes would misrepresent demand impacts and overly complicate the analysis.

Ideally, the analysis would be performed by switching spending from the conventional fuels category to the alternative fuels category, and then using consumer expenditures in the modeling; however, the aggregation of the fuels into the Petroleum and Coal Manufacturing NAICS code makes macroeconomic modeling of the LCFS regulation difficult. Instead, ARB modeled the change using the consumer price variables because they best estimate the flow of investment among consumers and suppliers of various fuels. The "price premium" is offset by the credit purchases by the petroleum industry and credit sales by low-CI fuels and are modeled as production cost changes. This same methodology was used for the SRIA and the updated analysis, the results of which can be found in Appendix F.

4. DOF Comment: The LCFS program relies on the supply of alternative fuels (and therefore the generation of credits). The analysis could be enhanced by discussing the volatility of credit prices, the interaction of credit prices and the incentives for innovation, and the cost impact on businesses and individuals; this discussion should include the cost-containment measure and its effects. The incentives for innovation will also depend on whether demand for less carbon-intensive fuels will be met through new production in California, or whether such fuels would be imported.

Fuel Availability and Credit Price

Just as the number of deficits generated is determined by the quantity and carbon intensity of conventional fuels sold in the California market, the supply of credits is determined by the quantity and carbon intensity of low-CI fuels sold in the California market.

The financial incentives provided by the LCFS credit value is anticipated to stimulate investments in, and production of, very low-CI fuels. The LCFS credit value represents a source of additional revenues for low-CI fuel producers and distributors, who can sell credits generated by their fuel. The LCFS credit value can offset the higher initial costs of producing low-CI fuels, and is anticipated to be used to reduce the higher initial price of those fuels to enable them to compete with conventional fuels. The value added from the sale of LCFS credits depends on the fuel's carbon intensity, the stringency of the annual standards, the LCFS credit price, and the volume of conventional fuel displaced.

Table 6: Value Added from the Sale of LCFS Credits

Fuel Type	Assumed CI in 2020	Value Added in 2020
Corn Ethanol	67.24	$ 0.18 / gallon
Cellulosic Ethanol	20.00	$ 0.56 / gallon
Waste Grease Biodiesel	14.97	$ 1.09 / gallon
Renewable Diesel	35.00	$ 0.78 / gallon

Renewable CNG	25.00	$ 0.91 / gallon

Because the supply of credits depends on the availability of low-CI fuels, market participants may face uncertainty regarding whether low-CI fuels will be available in sufficient volumes to achieve compliance, particularly in later years when the stringency of the regulation increases. Staff has analyzed the projected availability of low-CI fuel technologies, which is summarized in Chapter II. This analysis indicates that sufficient volumes of low-CI fuels will be available for compliance in all years analyzed. Historical data indicates a strong market response to the regulation stimulating demand for low-CI fuels. A Low Carbon Fuel Standard has been continuously implemented in California since 2010, and regulated parties have generated more credits than needed every year. The accumulation of banked credits has been augmented by a standard that will have been frozen at 1% through 2015. The scenario projects approximately 3.6 million banked credits available at the start of 2016.

Table 7: Deficits and Credits by Year (MMTs of Credits or Deficits)

Fuels	2016	2017	2018	2019	2020
Gasoline	-5.1	-7.3	-9.4	-12.9	-16.2
Ethanol	4.0	4.1	4.4	4.4	4.4
Electricity (LDV and HDV)	0.7	0.8	1.0	1.2	1.4
Renewable Gasoline	0.0	0.0	0.0	0.1	0.2
Hydrogen	0.0	0.0	0.1	0.1	0.1
Diesel	-0.9	-1.6	-2.2	-3.3	-4.4
Biodiesel	1.5	1.8	2.1	1.9	1.9
Renewable Diesel	2.1	2.5	2.6	2.8	3.0
Natural Gas	1.2	1.3	1.7	2.0	2.4

These values are based on a theoretical $100 LCFS credit price. The above values are rounded to the nearest tenth.

Since 2010, the production of low-CI fuels has increased in response to the financial incentives provided by the existing LCFS regulation. Many innovative, low-CI fuel technologies have moved past the demonstration stage, and have overcome techno-economic challenges that have in recent years limited the supplies of innovative, very-low CI fuels such as cellulosic ethanol, renewable diesel, and renewable natural gas. Staff analysis indicates that the supplies of low-CI fuels in future years (2016 – 2020) will continue to exhibit the existing trend of increasing production. As the scenario shows, existing low-CI fuel technologies are anticipated to continue to play a large role in achieving LCFS compliance. The stringency of the standard in later years demands increasing quantities of very-low CI fuels, and is anticipated to stimulate the increased production of innovative emerging and nascent technologies like renewable diesel, cellulosic ethanol, biomethane, and electric vehicles.

Incentives for Innovation

Staff has identified innovative low-CI fuel technologies that are poised to increase production at the commercial scale. The proposed regulation will increase the incentive to invest in and increase the production of innovative, very low-CI fuels, particularly as the stringency of the program increases in later years. A more stringent standard will likely result in higher credit prices, all else equal. Higher credit prices, particularly if they are sustained, will increase the incentive to innovate and invest because revenues generated by LCFS credits can be used to increase profit margins or to offset up-front capital costs; these additional revenues will attract investments in low-CI fuels.

The LCFS proposal provides opportunities for businesses within and outside of California to generate credits for low-CI transportation fuels. The proposed LCFS stimulates demand for low-CI fuels, which creates incentives to invest in and produce innovative low-CI fuels. Credits have a monetary value when sold in the LCFS credit market and can be generated by producers of low-CI biofuels, biomethane and natural gas providers selling CNG and LNG, fleet operators utilizing opt-in fuels such as electricity, utilities providing electricity for the residential fueling of electric vehicles, and service providers installing and maintaining public electric vehicle charging equipment. Because the LCFS is a fuel-neutral, performance-based standard, it provides equal incentives to businesses, regardless of location, to increase the production of low-CI fuels. It is unclear to what degree the demand for less carbon-intensive fuels will be met through new production in California or elsewhere. The proposed regulation provides the incentive structure to foster the low-CI fuels market; individual business decisions and the economics of producing the low-CI fuels will determine where the resultant increases in supplies comes from.

The proposed LCFS introduces competition into the fuels market. Firms that are early investors in innovative, low-CI fuel technologies may be at a competitive advantage if LCFS-like carbon-intensity standards are adopted by other jurisdictions.

The incentives for innovation will depend on the demand for less-carbon intensive fuels, which increases with the increasing stringency of the compliance curve. If the demand for low-CI fuel is met by new production in California, then the investment in California will likely be higher. However, the SRIA analysis did not rely on explicit assumptions of production location given that imbedded in the model are assumptions of regional purchasing and production which is dependent upon the NAICs code. Given that the REMI model does not accurately distinguish the conventional and alternative fuels, ARB relies on the imbedded assumptions for aggregation, production location, demand for fuels, prices, and many other factors that are fundamental to the model.

Cost Containment

If low-CI fuel technologies are slower to achieve commercialization than anticipated, or if there is insufficient investment in low-CI technologies, tight supply may cause upward pressure on credit prices from tight credit supply. Because the credit price is highly dependent on the availability and cost of production of low-CI fuels, and because the action of regulated parties

will determine the supply of credits, there is uncertainty regarding future supplies of credits. To reduce the risk of a potentially destabilizing price spike, and to reduce price volatility in the LCFS credit market, the proposed regulation includes a cost containment provision that is summarized in Chapter II. The proposed cost containment provision will cap credit prices and provide an upper bound on the potential cost of complying with the regulation. The proposed price cap will also limit the potential for volatility in the LCFS credit market. Based on a review of the literature and input from stakeholders, including during workshops, staff finds that a cost containment provision can reduce the risk of higher than anticipated costs while maintaining the environmental integrity of the program:

- The risk of higher than anticipated prices resulting from tight supply can be reduced by implementing a price cap and by ensuring regulated parties can achieve annual compliance even under conditions of tight supply.

- The environmental integrity of the program can be maintained by ensuring that the use of a cost containment provision does not relax the carbon intensity reductions that will be achieved by the program.

The price cap is proposed to be set at $200 / credit in 2016 and increase at the rate of inflation in subsequent years. Although a price cap that is set too low may limit the profitability of credit generators (i.e. low-CI fuel producers and distributors), staff analysis of the price cap indicates that $200/ton is high enough to provide a sufficient value added to stimulate the investments in and production of low-CI fuels, and sufficiently high to attract these fuels to California if they are produced elsewhere. The proposed price cap at $200 is anticipated to result in multiple, ancillary market benefits, including reduced price uncertainty, and reduced regulatory uncertainty. Reducing both these sources of uncertainty is anticipated to increase the incentives for investment. Potential investors may be hesitant to invest in low-CI fuel production facilities given conditions of undue uncertainty, particularly because production facilities for low-CI fuels are typically capital-intensive projects with relatively long payback periods.

5. It would greatly enhance transparency of the discussion to report these in terms of units that are more easily comparable, such as price increase per gallon or price decrease by kilowatt-hour. The economic impacts should also be reported in standard units such as constant dollars or numbers of jobs in addition to the percentages cited.

In the Economic Impacts chapter of the LCFS ISOR, results (outputs) of the macroeconomic modeling are expressed in constant dollars and percentages, and can be seen in Appendix F. Dollar-per-gallon price impacts are also included and displayed for the theoretical $100 credit price used for the macroeconomic results, and in addition shown for a $25 and $57 credit prices to show a range of potential impacts on consumers. See Appendix F of the ISOR for the outputs for the illustrative compliance scenario at the theoretical $100 credit price.

6. DOF Comment: The analysis could be supplemented by a discussion of the interaction between the LCFS program and the Cap and Trade program. Additionally, discussing the additional incentives for innovation due to the LCFS above and beyond the Cap and Trade program's contribution.

In the transportation sector, ARB has outlined a complementary, multi-pronged approach to meet the goals of AB 32. Fuel suppliers have a compliance obligation under the Cap-and-Trade program for the GHG emissions that result from the production and use of fuels. This provides an incentive to reduce emissions and sell cleaner fuels in the market. But it does not require cleaner fuels, as fuel suppliers can purchase allowances to cover their emissions if they so choose.

The LCFS requires that fuel providers supply cleaner fuels in California. As the LCFS reduces the carbon intensity of fuels, it changes the composition of the state's transportation fuel mix and dependence on traditional petroleum-based fuels.
The LCFS and Cap-and-Trade programs are designed to complement one another. Investments made to comply with one of the programs will result in reduced compliance requirements for the other program. Reductions in the carbon intensity of fuel due to the LCFS reduce compliance obligations under the Cap-and-Trade Program. Similarly, selling cleaner fuels to comply with Cap-and-Trade helps meet the requirements of the LCFS.

7. DOF Comment: The SRIA could do a better job of laying out how the low carbon fuel standards fit into the larger picture, and how the regulatory impacts may interact with other parts of the overall strategy for addressing carbon emissions.

See response to question 6. The Economic Impacts Chapter also discusses the effects of other programs such as Advanced Clean Cars and ARB's Pavley Vehicle Standards.

8. DOF Comment: The discussion of alternatives should be enhanced by including numbers so that readers can directly compare the impacts. Stating that there are lower costs under an alternative is not as useful as reporting on the magnitude of the difference.

These tables can be found in Appendix F in the ISOR.

9. DOF Comment: In the first alternative, we also suggest it should be designed so that there is the same carbon intensity standard for all transportation fuels, rather than just exempting diesel. That is, there should have been an offsetting decrease in carbon intensity for gasoline if diesel is exempted. This would raise costs for gasoline, which then could be compared to the avoided costs for diesel.

DOF suggested that ARB model a scenario, which was proposed to ARB by the California Trucking Association proposes an alternative regulation wherein the 10% reduction in the carbon intensity of the transportation fuels sold in California by 2020 (from a 2010 baseline) is achieved exclusively through a gasoline standard where diesel and diesel substitutes are

excluded from any carbon intensity requirements. Staff analyzed this alternative and determined that it cannot achieve the same level of CI reduction as the proposed regulation due to constraints in the available supply of low-CI gasoline alternatives and physical constraints such as the ethanol blendwall as well as limited penetration of electric and hydrogen vehicles and vehicles that can re-fuel with higher ethanol blends. With highly optimistic assumptions regarding the availability of very-low CI ethanol and highly optimistic assumptions regarding the reduction in carbon intensity values, staff analysis indicates that the gas only alternative could deliver a 7.7% reduction in the carbon intensity of the transportation fuels sold in California by 2020, from a 2010 baseline. Therefore it is not technically feasible for the gasoline only alternative to result in a 10 percent reduction in the carbon intensity of transportation fuels.

As it is anticipated to achieve only 7.7% of the goal of the proposed regulation, the gas only alternative not only falls short of providing a feasible pathway to achieve the proposed regulation's carbon intensity reductions, it is likely to deliver reduced benefits at an higher cost, compared with the proposed LCFS regulation.

This alternative has a lower than 10% reduction in the transportation sector CI level, and is cheaper than the LCFS regulation. However, this alternative will likely drive the price of credits higher, yielding a higher cost per MMT of reductions.

10. DOF Comment: Additional clarification of how the ADF costs are calculated and the reaction of businesses due to the NO_x controls required by the regulation.

The $14.5 million value was based on preliminary NO_x control costs originally estimated early in the analysis. The NO_x control costs have been updated and can be found in Chapter 10 of the ADF ISOR, summarized in Table 10.1. The updated economic impacts as identified in the LCFS and ADF ISOR economics chapters were re-evaluated using the REMI model; the inputs to and outputs from the REMI model can be found in in Appendix F in the ISOR.

11. DOF Comment: Additional clarification of the fiscal costs to the state for implementation of the regulations is needed. In addition, expansion of the discussion on price changes faced by the consumers, and state and local entities.

The fiscal costs were expanded and explained in both the LCFS and ADF 399 Fiscal Impact Assessments. Impact of the changing fuel volumes and prices on the budget can be found in Chapter 7 of the LCFS ISOR.

12. DOF Comment: Additional ARB personnel needed for the regulation should be identified.

The personnel need assessment was identified in the Fiscal Impact Assessment of Form 399.

Low Carbon Fuel Standard and Commercialization of Alternative Diesel Fuels
Standardized Regulatory Impact Assessment

A. Summary

Title 1, California Code of Regulations, sections 2000-2004 requires all State agencies that propose major regulations to complete a Standardized Regulatory Impact Assessment (SRIA). For the purposes of the SRIA, a major regulation is one that will result in either costs or benefits of more than $50 million in any given year of implementation.

The preliminary proposal was released almost two months prior to the SRIA submittal deadline to give stakeholders sufficient time to comment and propose alternatives, and allow for ample time to incorporate comments and alternatives into the analysis. The final Low Carbon Fuel Standard (LCFS) regulation and Commercialization of Alternative Diesel Fuels (ADF) regulation, to be proposed to the Air Resources Board for consideration of adoption in 2015, will be informed by continued interactions with stakeholders, external researchers, and other regulatory agencies. Due to the strongly complementary nature of these policies, the macroeconomic effects of the two programs are modeled together for the purposes of this SRIA (referred to as the combined LCFS/ADF proposal). The SRIA for both regulations, as required to be submitted to the Department of Finance, is presented below.

The economic impacts of LCFS and ADF proposed regulations on the California economy are negligible, considering the size and diversity of California's economy. ARB estimates the LCFS and ADF proposals will have a combined impact of reducing the growth in California's Gross State Product by less than 0.06 percent annually from 2016 through 2023.

1. Statement of the Need for and Goals of the Proposed Regulations

a) Statement of Need for LCFS

The California Air Resources Board (ARB) approved the LCFS regulation in 2009 as a discrete early action measure under the California Global Warming Solutions Act of 2006 (AB 32). The goal of the LCFS regulation is to reduce the carbon intensity of transportation fuels used in California by at least 10 percent by 2020 from a 2010 baseline, thereby reducing greenhouse gas emissions, among other benefits discussed below. ARB approved revisions to the LCFS in December 2011, which became effective on November 26, 2012, and were implemented by ARB on January 1, 2013.[1]

On July 15, 2013, the State of California Court of Appeal, Fifth Appellate District (Court) issued its opinion in POET, LLC versus California Air Resources Board (2013) 218 Cal.App.4th 681, resulting in a stay of the LCFS. The Court held that the LCFS adopted in 2009 and implemented in 2010 (referred to as 2010 LCFS) would remain in effect and that ARB could continue to implement and enforce the 2013 regulatory standards while taking steps to remedy California Environmental Quality Act (CEQA) and Administrative Procedure Act (APA) issues as required in the ruling.

[1] The current and complete regulatory text is available at: http://www.arb.ca.gov/fuels/lcfs/CleanFinalRegOrder_112612.pdf.

To address the court ruling, ARB will bring a revised LCFS regulation (LCFS proposal) and the ADF regulation to the Board for consideration in early 2015. The proposed LCFS regulation will contain revisions to the 2010 LCFS as well as new provisions designed to foster investments in the production of the low-CI fuels, offer additional flexibility to regulated parties, update critical technical information, simplify and streamline program operations, and enhance enforcement. The ADF regulation (ADF proposal) will accommodate the demand for ADFs driven by the federal Renewable Fuels Standard (RFS) and the LCFS while maintaining progress toward meeting California's air quality goals.

Due to the strongly complementary nature of these policies, the macroeconomic effects of the two programs are modeled together for the purposes of this SRIA (referred to as the combined LCFS/ADF proposal).

b) Goals of the LCFS Proposal

The primary goal of the LCFS proposal is to achieve a 10 percent reduction in the carbon intensity of California transportation fuels by 2020. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. In addition, the LCFS is designed to diversify California's transportation fuel portfolio and to create a durable regulatory framework that can be adopted by other jurisdictions. From these goals flow two important benefits: long-term reductions in transportation-sector GHG emissions (beyond those achievable through other regulations) and diversification of the fuel supply by providing consumers with more clean fuel choices.

Table 1: Proposed LCFS Compliance Schedule[2]

Year	Carbon Intensity for Gasoline and Substitutes (g/MJ)	Gasoline and Substitutes (% reduction)	Carbon Intensity for Diesel and Substitutes (g/MJ)	Diesel and Substitutes (% reduction)
2016	96.67	2.75%	100.30	2.75%
2017	94.93	4.50%	98.50	4.50%
2018	93.19	6.25%	96.69	6.25%
2019	94.45	8.00%	94.89	8.00%
2020	89.46	10.00%	92.83	10.00%

The LCFS proposal reduces the CI of the transportation fuels consumed in California through a system of credits and deficits. Supplying fuels with a CI above the current year's standard

[2] This table is based on updated indirect land use change (iLUC) and carbon intensity values that are a part of LCFS proposal and may be amended prior to Board approval.

generates deficits, while supplying fuels with a CI below the annual standard generates credits. Each credit represents a reduction of GHGs equivalent to one metric ton of CO_2-equivalent (CO_2e) emissions. Regulated parties that end the compliance year with a net deficit must retire sufficient credits to offset the deficits incurred. Regulated parties can choose from a mix of strategies to acquire credits, including: investing in the production of low-CI fuels, which will generate credits; purchasing low-CI fuels for blending with traditional hydrocarbon fuels; purchasing credits in the LCFS market from other regulated parties; and banking credits for use in future years, as the stringency of the standard increases.

The LCFS proposal outlines the revised CI standards for each year from 2016 through 2020. One CI standard is established for gasoline and the alternative fuels that can replace it, while a second CI standard is established for diesel fuel and its replacements. Table 1 outlines the CI standards from 2016 through 2020 that are the basis for this assessment.

c) Goals of the ADF Proposal

The primary goals of the ADF proposal are two-fold: 1) establish a comprehensive, multi-stage process governing the commercialization of ADF formulations in California, and 2) to establish special provisions for biodiesel as the first recognized ADF to permit its use within the commercial fuels market in volumes and blends that will result in no significant adverse impacts on public health or the environment relative to conventional petroleum CARB diesel. Regulation of ADFs is necessary to ensure that the rapid development of these fuels does not interfere with the public health and environmental standards.

Biodiesel has already gone through a multi-stage process similar to the process undergone by other fuels, including ethanol and renewable diesel; the ADF proposal seeks to expand the process to the commercialization of all ADFs. The process includes a multimedia evaluation comparing an ADF to the fuel it replaces, development of consensus standards, and engine manufacturer approval. The multi-stage process may identify significant emissions impacts; if so, this results in the determination of a significance threshold below which no significant emissions impacts are expected to occur for a given pollutant. Because the multi-stage process is predominantly a streamlining of existing requirements, it does not significantly affect the benefits or costs discussed in this document.

Biodiesel use results in reductions of total particulate matter (PM), hydrocarbons and carbon monoxide (CO), but can lead to increased oxides of nitrogen (NO_X) emissions, depending on the biodiesel feedstock and the engine in which the biodiesel is used. The NO_X increases are not found in light-duty vehicles, medium-duty vehicles, or new-technology diesel engines (NTDE). NTDEs are generally engines equipped with selective catalytic reduction devices that control NO_X emissions post-combustion (i.e., in the exhaust). NTDEs are expected to represent 95 percent of heavy-duty engines by the end of 2023. ARB and others have extensively studied the impacts of biodiesel on NO_X emissions; additional studies and analysis, including a comprehensive literature search, can be found on the ARB website.[3]

[3] http://www.arb.ca.gov/fuels/diesel/altdiesel/biodocs.htm

The multimedia evaluation process for biodiesels made from various feedstocks identified a NO_X significance threshold, or blend level, that will result in no significant adverse impacts. The ADF proposal seeks to mitigate NO_x impacts from biodiesel by setting a significance threshold and requiring mitigation of all non-animal biodiesel use at blends above one percent, and all animal biodiesel used at blends above five percent. The ADF proposal identified one percent for non-animal biodiesel, rather than zero percent, because biodiesel may be used as an essential lubricity additive at one percent or less.

There are several potentially viable NO_x mitigation options that have been outlined and presented to the public.[4] Staff identifies three mitigation options including: use of additives, blending biodiesel with renewable diesel (RD), and contracting with RD providers to supply RD in the same areas at which biodiesel is used. In addition to the mitigation options above, staff is proposing exemptions for biodiesel sold to fleets that are 95 percent light-duty or NDTEs. The regulation would be implemented starting January 1, 2016, and the biodiesel mitigation provisions of the ADF proposal would sunset once the NTDE population reaches 95 percent of the heavy-duty fleet, which is expected to occur at the end of 2023.

2. Major Regulation Determination

The LCFS proposal was determined to be a major regulation because the direct cost of compliance exceeds $50 million in all years analyzed, 2016 through 2020. The absolute value for ADF proposal costs plus benefits may exceed $50 million in economic impacts in a twelve-month period following full implementation. The direct costs of the preliminary ADF proposal are highest in the year 2022 at $14.57 million. It is unclear what the indirect and induced costs are for the ADF regulation. However, given the interaction between the ADF proposal and the LCFS proposal, staff is addressing the costs and benefits of both proposals in this SRIA.

3. Baseline Information

Regulations and trends found in the baseline or business-as-usual (BAU) scenarios are outlined below, as well as a description of how they were modeled in the baseline Computable General Equilibrium (CGE) run:
The baseline does not include the LCFS or the ADF proposal; it does, however, include regulatory measures that influence the types and carbon intensities of transportation fuels consumed in California. These include:

- Advanced Clean Cars (ACC)
- Corporate Average Fuel Economy (CAFE) Standards
- U.S. Environmental Protection Agency's (U.S. EPA) Renewable Fuel Standard 2 (RFS2)
- State and Federal Transportation Fuel Trends
- ARB's In-Use Mobile Diesel Vehicle Regulations

4. Public Outreach and Input

Since the LCFS adoption, ARB has been in frequent contact with stakeholders and the general

[4] http://www.arb.ca.gov/fuels/diesel/altdiesel/biodiesel.htm and http://www.arb.ca.gov/fuels/diesel/altdiesel/meetings/meetings.htm

public regarding the 2010 LCFS. Recently, the outreach has focused on strengthening the LCFS proposal. In 2013 and 2014, ARB conducted 15 public workshops on regulatory provisions and the re-adoption process.[5] Information regarding these workshops and any associated materials are posted on the ARB website and distributed through a public list serve that includes over 8,000 recipients. At the meetings, which are webcast, available by teleconference, or both, ARB solicits stakeholder feedback on the regulation and the regulatory process.

ARB has also made a concerted outreach effort to seek public input regarding the alternatives for LCFS analyzed for this SRIA.

- May 20, 2014: ARB posted the upcoming May 30, 2014, Public Workshop notification on the LCFS website, which included a solicitation of alternatives.
- May 23, 2014: ARB posted the Solicitation of Alternatives for Analysis in the LCFS Standardized Regulatory Impact Assessment and Under the California Environmental Quality Act on the LCFS website.
- May 30, 2014: ARB solicited public input and alternatives for analysis in the SRIA during the May 30, 2014, Public Workshop.
- June 5, 2014: ARB extended the deadline for the submission of alternatives for analysis in the SRIA. In response, five alternatives to the LCFS proposal were submitted.

The announcements for public workshops regarding ADF were posted on the ARB website[6] and distributed through a listserve that included over 7,000 recipients. All materials presented at the workshops were also posted on the ARB website. The most recent workshops include:

- February 13, 2014: Public Workshop to discuss biodiesel use in extreme non-attainment areas and other concepts.
- April 17, 2014: Public Workshop to discuss the regulatory strategy of the ADF proposal.
- July 1, 2014: Public Workshop to discuss data from recently completed studies.

In addition to continuing efforts to solicit feedback from stakeholders about alternatives, exemptions, and alterations of the ADF and LCFS proposals, formal alternatives solicitation processes was implemented. A solicitation letter was sent via listserve and posted on the respective regulation websites; and responses are outlined in the alternatives section of this document.

B. Benefits

i. Benefits of LCFS

The LCFS proposal is anticipated to deliver environmental benefits that include an estimated reduction in the greenhouse gas (GHG) emissions of more than 40 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) from transportation fuels used in California from 2016 through 2020. Implementation of the LCFS proposal will also diversify the transportation fuel portfolio, thereby reducing the economic impact of volatile global oil price changes on gasoline

[5] Information pertaining to the workshops is available at: http://www.arb.ca.gov/fuels/lcfs/lcfs_meetings/lcfs_meetings.htm.
[6] Same as footnote #4

and diesel prices in California.

The LCFS proposal is expected to improve California's air quality. In fact, the LCFS proposal may reduce criteria pollutant emissions from the 2020 projected vehicle fleet, predominately attributable to reductions in diesel use. The LCFS proposal is anticipated to deliver environmental benefits that include a cumulative estimated reduction in the $PM_{2.5}$ emissions of more than 1200 tons from transportation fuels in California from 2016 through 2020. These emissions reductions include the reduced tailpipe emissions of $PM_{2.5}$ associated with the replacement of conventional diesel with substitute fuels net of any increased emissions of $PM_{2.5}$ associated with feedstock and fuel truck trips from additional California biofuel production facilities and transport from out-of-state biorefineries. Any additional NO_X emissions that result from the increased use of biodiesel blends are required to be mitigated by the Alternative Diesel Fuel regulation.

ii. Benefits of the ADF

As the biodiesel provisions of ADF are expected to sunset at the end of 2023, the analysis was conducted from the expected starting year of 2016 to 2023. Please note that although 2023 is the expected last year of mitigation, the biodiesel provisions may sunset earlier if the heavy-duty fleet is 95 percent NTDE which would result in benefits occurring sooner than outlined in this SRIA.

ARB and others have extensively studied and analyzed the effects of biodiesel blends on NO_x emissions. An evaluation of recent research on B5 and B10 blend levels indicates that NO_x emissions are higher with an increasing plant-based biodiesel blend level. For the purposes of this SRIA, ARB proposes mitigating all NO_X emissions from biodiesel blends above one percent for non-animal biodiesel and five percent for animal biodiesel. Compared to the BAU scenario, which includes biodiesel that is used without mitigation and without an LCFS, this would yield a reduction in the amount of NO_X emitted by biodiesel blends. ARB estimates that the magnitude of NO_X reductions could be as large as 1,100 tons per year in the highest year, and cumulatively almost 5,000 tons from 2016 to 2023. Additionally, as a benefit of reducing NO_X, secondary PM nitrates formed from NO_X will be reduced. The anticipated NO_X reductions from the combined LCFS/ADF proposal, and attributed to the ADF proposal, are outlined in Table 2.

Table 2: Annual Statewide NO_X Emission Reduction Benefits of the ADF Proposal

Year	2016	2017	2018	2019	2020	2021	2022	2023	Total

NO_X Emissions Reductions (tons per year)	1,079	986	878	812	492	358	271	90	4,965

Increases in fuel volumes, to the extent that they occur, can be attributed to the LCFS proposal, and as such the particulate matter, total hydrocarbon, or carbon monoxide emissions benefits from any increase in biodiesel use would be attributable to the LCFS proposal rather than the ADF proposal.

3. Benefits to Individuals

Based on the modeled compliance scenario, the LCFS proposal results in reduced criteria and toxic emissions, and the ADF proposal maintains the NO_X emissions level of CARB diesel with increased biodiesel use. These proposed regulations benefit individuals in California through the health benefits of breathing cleaner air. Additionally, residents of California will enjoy improved air quality in the form of decreases in ground-level ozone relative to the baseline scenario. Individuals in California will also benefit from increased options in cleaner transportation fuels.

This will result in a reduction in the risk for premature deaths, hospital visits, emergency room visits for asthma, and a variety of other health effects, especially in sensitive receptors including children, elderly, and people with chronic heart or lung disease.

The LCFS will also result in reduced U.S. oil consumption, resulting in energy security benefits, such as the avoided national economic losses associated with the risk of macroeconomic disruption caused by oil supply shocks.

4. Benefits to California Businesses

The LCFS proposal provides opportunities for businesses, within and outside of California, to generate credits for low-CI transportation fuels. Credits have a monetary value when sold in the LCFS credit market and can be generated by regulated parties and by entities that opt in to the regulation, such as producers of low-CI biofuel producers, fleet operators utilizing opt-in fuels such as NG and electricity, utilities providing electricity for the residential fueling of electric vehicles, and service providers installing and maintaining public electric vehicle charging equipment. California businesses may also benefit from a larger portfolio of cleaner transportation fuels for fleet and service vehicles.

5. Benefits to Small Businesses

The LCFS proposal may increase the fuel options for small businesses, which could impact total fuel consumption and expenditures.

Most California biodiesel are small businesses. In addition, the ADF proposal may expand the market for some or all alternative diesel fuels, many of which are produced by small businesses, including small businesses in and outside of California; however, in the early years much of the benefits may be offset by the reduction in volumes of biodiesel that will likely result from the combined LCFS/ADF proposal. In addition, small businesses that produce low-CI fuels can opt into the regulation and generate credits for LCFS. The ADF proposal results in an overall expansion in the market for renewable diesel and other ADFs in California, and

California businesses may benefit from a greater choice for their transportation fuels as a result of both proposals.

C. Direct Costs

1. Costs to Individuals

There are no direct initial regulatory costs incurred by individuals, as fuel providers and not individual consumers are the regulated party. Staff anticipates that the combined LCFS/ADF proposal could result in an increase in the cost of conventional fuels, which constitutes an indirect cost to consumers of conventional fuels.

2. Costs to Businesses

i. Costs to Businesses for LCFS

There are no initial costs to the LCFS regulation, as much of the infrastructure is already in place. ARB estimated the direct costs of compliance with the combined LCFS/ADF proposal for 2016 through 2023. The direct cost of the combined LCFS/ADF proposal is the additional cost of complying with the proposed regulation that is borne by regulated parties. As the LCFS is a market-based program, the price of LCFS credits can be used to estimate the cost of complying with the regulation. For the LCFS, regulated parties demonstrate compliance by surrendering one credit for every deficit incurred by their sales of fuels that have CI values over the annual standard. In this assessment an upper bound of the cost of compliance is estimated by multiplying the number of LCFS deficits generated in each year by the price of LCFS credits sold through bilateral transactions between parties and registered in the LCFS Reporting Tool (LRT).

The estimated direct cost to regulated parties is highly sensitive to the price of LCFS credits, which are based on the supply and demand for credits in the market and cannot be forecast with certainty, as well as the mitigation pathway chosen by biodiesel producers. From 2012 through 2013, while the LCFS standards for gasoline and diesel were declining, the average credit price reported in the LRT was $57.[7] Based on historic credit prices and the fuel volumes that will be required to meet the increasing stringency of the LCFS proposal, ARB assumes a credit price of $100 for the period 2016 through 2020. This method likely over-estimates costs because many (or even most) lower-CI fuels with embedded credits can be generated and secured at costs lower than the market price for stand-alone credits.

Regulated parties can either generate credits themselves by purchasing low-CI fuels and reporting them in the LRT, or they can go out into the market and buy LCFS credits generated by others. In 2013, California's seven major refineries self-generated a vast majority of their compliance obligation through the purchase of low-CI fuels.[8] In addition, the credit price represents the marginal cost of abatement-or the cost of the last ton of emission reductions to comply-most other reductions will be achieved at a lower price. For our analysis, we are

[7] Weighted average of quarterly LCFS credit prices reported through the LRT available at: http://www.arb.ca.gov/fuels/lcfs/lrtmonthlycreditreports.htm.
[8] Information obtained through business confidential transactions reported through the LRT.

assuming that all of the credits in the system are valued at the same price: $100. This approach is conservative, as credits can be generated at a lower cost, and the credit price is not known with certainty.

ii. Costs to Businesses for ADF

The initial direct costs incurred by regulated parties due to the ADF proposal is estimated as an $880,600 annualized capital cost, which covers the cost of two new refinery facilities that will be needed to handle the additive requirements for the regulation. There are no initial costs to the LCFS regulation, as much of the infrastructure is already in place. As discussed above, the ADF proposal has two parts: the multi-stage evaluation of new ADFs, and provisions for biodiesel use. The proposal's multi-stage portion consolidates existing requirements and adds certain low-cost procedures, so it is not expected to substantially increase costs.[9] Therefore, this section will focus primarily on the costs incurred by the biodiesel provisions portion of the ADF proposal. To account for the annual operating and maintenance cost of the new facilities required to inject additives, ARB includes an additional $40,000 per year for both facilities.

For the ADF provisions, ARB assumes that most biodiesel producers would opt to use the least costly mitigation option, which is the renewable diesel contracting option. However, where that option is unavailable, ARB assumes biodiesel producers would use the next lowest cost option, which is blending biodiesel with RD. Finally, ARB assumes that in remote areas where RD may be unavailable, biodiesel producers may opt to use additives. The estimated direct cost to regulated parties is highly sensitive to the mitigation option chosen, new technology, and turnover of the heavy duty diesel fleet. The estimated cost of compliance for all regulated parties is based on a hypothetical mitigation pathway using RD contracting 80 percent of the time, RD blending 15 percent of the time, and additives 5 percent of the time. Notice that costs plateau in 2022, when the rate of increase in NTDE proportion is greater than the rate of growth in biodiesel.

Detailed market sales and related information would be required to be reported by biodiesel producers to ensure compliance with the ADF proposal. The primary costs involved will be the cost of recording and reporting essential information, including but not limited to: monthly biodiesel sales volumes by blend; geographic location of biodiesel marketers along with their specific blend sales; fleet-specific information (which fleets are using what blends and the fleets using new technology diesel engines, etc.); the volume of RD and other low-NO_x fuel sales by geographic location; and the sales of biodiesel products from animal tallow feedstocks. ARB estimates that it would take 40 hours per affected producer to comply with the recordkeeping and reporting requirements (at $40 an hour). These reporting costs would equal $35,200 per year for the affected industry, which is comprised predominantly of small businesses.

[9] Much of the benefit of the multi-stage evaluation portion is in the aggregation and additional clarity provided for the requirements, as well as the formation of a holistic process.

Some of the increased costs for fuel would be borne by businesses, though this may result in a cost-savings if these businesses choose more efficient fuels.

D. Economic Impacts

1. Methodology for Determining Economic Impacts

While the direct regulatory costs of the combined LCFS/ADF proposal can be estimated using the price of LCFS credits, the indirect costs and economic impacts are modeled using a computational general equilibrium model of the California economy known as Regional Economic Models, Inc. (REMI). The REMI model generates year-by-year estimates of the total regional effects of a policy or set of policies. ARB used the REMI PI+ model for this analysis—a one-region, 160-sector model that has been modified by the Department of Finance to include California-specific data for population, demographics, and employment.[10]

The modeling results reflect the combined economic impacts of the ADF and LCFS proposals and cannot be disaggregated.

2. Inputs of the Assessment

The LCFS/ADF proposal allows for many compliance strategies. The LCFS proposal does not dictate the types and quantities of fuel used for compliance, but instead relies on a market-based approach to allow the lowest possible cost of compliance. To estimate the economic impacts of the combined LCFS/ADF proposal, ARB has chosen one potential compliance scenario among the many potential compliance paths. This compliance scenario includes the volumes and types of fuels consumed in California each year for compliance with the combined LCFS/ADF proposal. The compliance scenario has been constructed with input from stakeholders and external researchers. It utilizes fuels that are technically feasible and that are expected to be available at the needed volumes during the time frame of the analysis. The fuels included in the compliance scenario are:

[10] Information regarding the Department of Finance's affiliation with REMI and baseline scenario modifications is available at: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/view.php.

- California Reformulated Gasoline (E10 and E85)
- Corn Ethanol
- Sorghum Ethanol
- Cane Ethanol
- Cellulosic Ethanol
- Sorghum/Corn/Wheat Slurry Ethanol
- Renewable Gasoline
- Hydrogen
- Electricity for Light- and Heavy-Duty Vehicles
- CARB Diesel
- Soy Biodiesel
- Waste Grease Biodiesel
- Tallow Biodiesel
- Corn Oil Biodiesel
- Renewable Tallow Diesel
- Liquefied Natural Gas (LNG)
- Compressed Natural Gas (CNG)
- Renewable LNG
- Renewable CNG

The combined LCFS/ADF proposal was modeled in REMI as a change in consumer transportation fuel expenditures because the regulations will change the type, the volume, and the price of fuel consumed in California. Calculating the change in transportation fuel expenditures requires analyzing two effects of the LCFS/ADF proposal: a fuel substitution effect, which is the change in the types of fuels consumed, and a price effect, which is the change in the prices paid for those fuels.

The fuel substitution effect of the LCFS/ADF proposal is quantified as the difference in the volumes and types of fuels consumed for compliance and the volumes and types of fuels consumed in the baseline scenario, in the absence of the proposed regulations. In the compliance scenario, conventional fuel volumes decrease, while the quantity of lower-CI fuels, including biodiesel, cellulosic ethanol, and renewable NG, increases.

To model changes in consumer spending on transportation fuels, ARB estimated the price effect of the LCFS/ADF proposal, or the change in fuel prices once the LCFS credit price is reflected in the price of fuels. For the baseline scenario, ARB constructed a forecast of California fuel prices over the period 2016 through 2023. The fuel prices are based on the 2014 U.S. Energy Information Agency's (EIA) Annual Energy Outlook reference scenario.[11] As EIA forecasts national fuel prices, ARB made adjustments to account for the difference between California and national fuel prices. This was done by adjusting the gasoline and diesel prices upward by the average price differential between the weekly reported California and national fuel prices from 2007 through 2014, and natural gas (NG) was similarly adjusted using monthly data for the same time period.

The California-adjusted baseline fuel prices were further adjusted to reflect the value of the LCFS credit price that is either generated with the production of low-CI fuel or must be purchased to cover the deficits incurred by high-CI fuels. The price of gasoline and conventional diesel are increased to reflect the purchase of credits required to cover the deficits incurred by these fuels. The credit value is reflected in the final price of electricity on a per-kilowatt basis as the difference in CI between electricity and gasoline or diesel, respectively. The LCFS credit value is not reflected in the retail price of alternative fuels. Rather, ARB assumes that fungible alternatives to gasoline and diesel (i.e., ethanol, biodiesel, and renewable diesel) will be priced at parity on a volumetric basis to the fuels they replace.

The total fuel expenditure was calculated for the compliance scenario on a fuel-by-fuel basis and compared to the expenditures incurred in the baseline scenario, as seen in the equation below.

Changes in expenditures = (fuel demand $_{\text{with LCFS + ADF}}$ * fuel prices $_{\text{with LCFS + ADF}}$) - (fuel

[11] For petroleum and other liquids more information is available at: http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=0-AEO2014&table=12-AEO2014&region=0-0&cases=ref2014-d102413a.
For NG and electricity, more information can be found at: http://www.eia.gov/oiaf/aeo/tablebrowser/#release=AEO2014&subject=0-AEO2014&table=3-AEO2014&region=1-0&cases=ref2014-d102413a.

demand $_{\text{without LCFS + ADF}}$ * fuel prices $_{\text{without LCFS + ADF}}$)

These expenditures are translated into a shift in consumer prices and input into the REMI model. REMI models consumer spending using highly aggregated expenditure categories similar to the North American Industrial Classification System (NAICS) codes. These categories combine similar products into groups such that all products in a group will have the same characteristics in the model. The calculated expenditures are input into REMI through a variable called "consumer prices," which changes prices by consumption category. Changing "consumer prices" for transportation fuel means that all businesses and consumers that purchase final products from an affected category (here transportation fuels) will face the same price change.

In the REMI model, transportation fuel expenditures and prices are separated into three highly aggregated categories: motor vehicle fuels (including lubricants and fluids), NG, and electricity. The motor vehicle fuels category, for instance, not only models changes in consumption of gasoline and diesel but their alternatives (not including NG and electricity). Biodiesel, renewable diesel, and diesel are all treated the same in the model as they are all classified as motor vehicle fuels. As presented in Table 3, the expenditures on motor vehicle fuels increase as a result of the LCFS/ADF proposal.

As modeled, expenditures on electricity are anticipated to decrease slightly with the LCFS/ADF proposal. As the penetration of electric vehicles is driven primarily by compliance with other ARB regulations—notably the Advanced Clean Cars regulation—the combined LCFS/ADF proposal does not increase the total quantity of electricity consumed as a transportation fuel. However, the value of the LCFS credit decreases the price of electricity relative to the baseline scenario. For this reason, overall expenditures on electricity decrease due to the combined LCFS/ADF proposal.

Table 3: Changes in Consumer Expenditures (Millions 2009$) on Transportation Fuels

REMI Category	Fuels	2016	2017	2018	2019	2020	2021	2022	2023
Motor vehicle fuels, lubricants, and fluids	Gasoline and Diesel	-383	-390	-492	-602	-970	-1,012	-1,026	-968
	Renewable Diesel, Renewable Gasoline, Ethanol and Biodiesel	897	1,210	1,619	2,019	2,698	2,725	2,729	2,751
Natural Gas	Natural Gas (LNG and CNG)	1	1	-1	1	1	1	-1	0
Electricity	Electricity	-56	-64	-82	-106	-140	-179	-223	-272

These values are based on $100 LCFS credit price.

While prices of transportation fuels will change due to the impact of the LCFS credit on consumer spending, an additional step is required to input the change in the costs to fuel providers of the LCFS/ADF proposal. For a conventional fuel provider, an increase in the retail price of gasoline or diesel increases revenue. For an electricity provider, a lower final price for electricity (due to the value of the LCFS credit generated with the low-CI fuel) leads to a reduction in revenue in the REMI model. An additional step is required to account for the transfer of credits from the electricity providers to the conventional fuel providers to cover the deficits incurred by the high-CI fuels. Ideally, the transfer would be input as an increase in revenue for the alternative fuel firms, and a decrease in revenue for conventional fuels. However, due to the construction of REMI, ARB simulates the transfer of credits between high-CI and electricity providers as an increase in the production cost for conventional fuels and a decrease in production cost for electricity. For alternative fuel producers (excluding natural gas and electricity), the increase in revenue is assumed to equal the difference between their actual production cost and the average production cost of all fuel producers- which is aggregated in REMI.

The compliance scenario illustrates one pathway of fuel volumes that can achieve the goals of the LCFS/ADF proposal. From the volumes of fuel in the compliance scenario, ARB calculates the credits and deficits each year, multiplies the number of deficits generated by the $100 assumed credit price, and passes those costs to the regulated fuel providers as an increase in production cost for conventional fuels. Similarly, the credits generated are multiplied by the $100 assumed credit price, and that revenue is passed through as a decrease in production cost for electricity as shown in Table 4. However, the industrial categories, as related to transportation fuel, are highly aggregated in the REMI model and include: petroleum and coal products manufacturing (conventional fuels), basic chemical manufacturing (ethanol), natural gas distribution,

and electric power generation, transmission, and distribution. The high level of aggregation in the modeling may not accurately capture the incentives for innovation that could occur as a result of the LCFS/ADF proposal.

Table 4: Distribution of LCFS Credit Value, Represented as Changes in Production Cost (Expenditures in Million 2009$)

NAICS Industry	Fuels	2016	2017	2018	2019	2020	2021	2022	2023
Petroleum and coal products manufacturing	**Gasoline and Diesel**	497	798	1,087	1,365	1,663	1,645	1,625	1,603
Natural gas distribution	**Natural Gas (LNG and CNG)**	-113	-138	-159	-180	-199	-230	-265	-301
Electric power generation, transmission, and distribution	**Electricity**	-56	-64	-82	-107	-141	-180	-224	-274

These values are based on $100 LCFS credit price.

ARB also modeled the administrative costs of the LCFS/ADF proposal by changing labor productivity to account for record-keeping and administrative costs to regulated entities. ARB also adjusted exports such that a reduction in California's domestic demand for transportation fuels results in proportional increases in exports of transportation fuels to other jurisdictions using the unadjusted AEO base price. This inverse trade relationship is reflected in historical trends of demand in California, as identified by the AEO historic data and exports as identified by the U.S. Census. Additionally, world oil demand is forecasted to increase[12] by 38 percent by 2040 providing sufficient global demand for California's increased exports.[13]

3. Assumptions and Limitations of the Model

As illustrated in Tables 3 and 4, expenditure categories in the REMI model are highly aggregated. The aggregated expenditure categories may limit the degree to which Computable General Equilibrium (CGE) models like REMI are able to fully represent nuanced changes within a sector. Aggregated expenditure categories limit the ability of the model to fully reflect the fuel substitution effects of the LCFS/ADF proposal. The REMI model processes a dollar spent on any fuel, regardless of CI, equally. This implies that REMI may not accurately represent how expenditures on low-CI fuels move

[12] http://www.nytimes.com/2012/03/09/us/oil-exports-have-become-huge-business-in-the-san-francisco-bay-area.html?_r=0

[13] http://www.eia.gov/pressroom/releases/press412.cfm

through the economy.
The following assumptions are used in the modeling of the LCFS/ADF proposal:

- LCFS credit price is $100 from 2016 through 2023;
- The full LCFS credit price is reflected in the final price of conventional fuels;
- The full value of the LCFS credit associated with electricity as a transportation fuel is reflected in a reduced electricity rate for electricity consumers;
- LCFS credit values are simulated as a decrease in production cost for natural gas and electricity and an increase in production cost for conventional fuels;
- Alternative fuels are priced at parity with their fungible conventional fuel;
- Production of conventional fuels in California remains static due to increasing exports offsetting anticipated reduction in conventional fuel demand in California;
- The volumes and types of fuels in the compliance scenario come on-line as anticipated; and
- Hydrogen is included in the volumes for the compliance scenario but excluded from the expenditure changes due to lack of reliable price data; therefore, any credit value associated with hydrogen is not included in the analysis.

4. Results of the Assessment

a) California Employment Impacts

As modeled, the LCFS/ADF proposal will have very small but negative impacts on employment growth from 2016 through 2023. Table 5 shows that, with an LCFS credit price of $100, the growth in employment is reduced annually from 0.01 percent to 0.07 percent. Table 5 outlines the change in employment growth each year, comparing the baseline scenario with the compliance scenario for the LCFS/ADF proposal. ARB interprets these results as negligible given the size of California's $2 trillion economy, and the uncertainty regarding inputs, particularly future prices for LCFS credits.

Table 5: Changes in Employment Growth

	2016	2017	2018	2019	2020	2021	2022	2023
Change	-0.01%	-0.03%	-0.04%	-0.06%	-0.07%	-0.07%	-0.07%	-0.07%

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead year-by-year changes.

b) California Business Impacts

The modeling results show that the LCFS/ADF proposal may generally produce a slight increase in the output across all sectors affected from 2016 through 2023. The results reflect the increased demand for alternative fuels, modeled as increased production in the petroleum and coal manufacturing sector. The growth in the petroleum manufacturing sector is likely explained by the assumed increase in exports in response

to decreases in California demand for conventional fuels. There is no change in revenue for the electricity sector as the credit value received in the form of a production cost decrease is directly passed to the consumer and the consumer faces a lower electricity price. Similarly, the basic chemical manufacturing sector, which includes ethanol, obtains revenue from the LCFS credits, but does not see a reduction in the price for their product. Therefore, ethanol producers, in California and elsewhere, should see increases in output due to increased prices, reduced production costs, and increased demand. Table 6 presents the growth in the output of California's transportation fuels industry and includes both conventional and alternative fuels.

Table 6: Changes in Output Growth

	2016	2017	2018	2019	2020	2021	2022	2023
Electric Power Generation, Transmission, and Distribution	0.18%	0.21%	0.26%	0.34%	0.44%	0.55%	0.69%	0.84%
Natural Gas Distribution	0.13%	0.21%	0.29%	0.35%	0.42%	0.49%	0.57%	0.65%
Basic Chemical Manufacturing	-0.01%	-0.01%	-0.02%	-0.02%	-0.03%	-0.03%	-0.03%	-0.03%
Petroleum and Coal Products Manufacturing	0.30%	0.11%	-0.06%	-0.28%	-0.36%	-0.68%	-0.94%	-1.19%

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year.

c) Impacts on Investments in California

As modeled, the LCFS/ADF proposal would produce very small investment impacts from 2016 through 2023. Table 7 shows that, at a credit price of $100, the annual change in the growth of investments in California ranges from a decrease of 0.01 to 0.11 percent, representing a slight slowing of growth but not a discernable change from the baseline scenario. ARB interprets these results as insignificant given the size of California's $2 trillion economy and the uncertainty regarding inputs, particularly future prices for LCFS credits. Additionally, limitations prevent the proper modeling of the incentives for investment that the combined LCFS/ADF proposal is likely to provide by diversifying the fuel mix.

Table 7: Change in Gross Domestic Private Investment Growth

	2016	2017	2018	2019	2020	2021	2022	2023
Private Investment	-0.01%	-0.04%	-0.07%	-0.09%	-0.11%	-0.11%	-0.11%	-0.10%

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year.

d) Impacts on Individuals in California

The combined LCFS/ADF proposal would produce a very small change in personal income for all years analyzed, 2016 through 2023. Table 8 shows that with a credit price of $100, the change in the growth of personal income ranges from a decrease of 0.01 to 0.05 percent annually. The changes in the growth of personal income correlate with the modeled reduction in employment in California, which are in the same range and negligible size relative to the size of the California economy.

Table 8: Changes in Personal Income Growth

	2016	2017	2018	2019	2020	2021	2022	2023
Personal Income	-0.01%	-0.02%	-0.03%	-0.04%	-0.05%	-0.05%	-0.05%	-0.05%

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year.

e) Impacts on Gross State Product (GSP)

Table 9 shows that the annual change in the growth of GSP ranges from a decrease of 0.01 to 0.06 percent, depending upon the year. ARB interprets these results as small relative to the size of California's $2 trillion economy and the uncertainty regarding inputs, particularly future prices for LCFS credits.

Table 9: Changes in Gross State Product Growth

	2016	2017	2018	2019	2020	2021	2022	2023
GSP	-0.01%	-0.02%	-0.03%	-0.04%	-0.05%	-0.06%	-0.06%	-0.06%

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year.

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

The LCFS/ADF proposal encourages the production and consumption of innovative, low-CI transportation fuels. The LCFS/ADF proposal provides a market for innovative alternative fuels through 2023, and as modeled, can shift California's consumption of transportation fuels from polluting, high-carbon-intensity energy sources to clean,

low-carbon-intensity fuels and efficient technologies with little or no economic penalty. These results are consistent with other economic analyses of California's 2010 LCFS and other AB 32 regulations.

As modeled, the LCFS/ADF proposal is unlikely to significantly impact California's economy. The impact of the LCFS/ADF proposal on the growth of employment, investment, personal income, transportation sector output, and gross state product does not represent a significant change from the baseline scenario.

E. Alternatives

1. Alternatives Analyzed: LCFS

ARB published a solicitation to stakeholders seeking public input regarding alternatives to the LCFS proposal on May 23, 2014. The solicitation was sent by a listserve to stakeholders in an effort to reach as wide an audience as possible. There were five responses to the solicitation: four that are outlined in Appendix A, and one alternative that is considered below. ARB proposed another alternative, and both were modeled using the REMI software consistent with the modeling of the LCFS proposal.

The primary goal of the LCFS proposal is to reduce the carbon intensity of transportation fuels in California by 10 percent by 2020, from a 2010 baseline. In addition, the LCFS is designed to diversify California's transportation fuel portfolio and to create a durable regulatory framework that can be exported to other jurisdictions. Given the multiple benefits of the LCFS proposal, ARB evaluated alternatives on the basis of their ability to achieve the carbon intensity goals of the LCFS proposal, not solely by their impact on GHG emissions. ARB analyzed two alternatives: one less stringent than the LCFS proposal, and one more stringent than the LCFS proposal. The alternatives and their compliance schedules are outlined in Table 10.

Table 10: Comparison of LCFS Compliance Schedules (Percent Reduction in Carbon Intensity)

Year	2010 LCFS	LCFS Proposal	Alternative 1: Gasoline Only	Alternative 2: Original CI reduction curve
2016	3.5%	2.75%	2.75%*	5.0%
2017	5.0%	4.5%	4.5%*	6.0%
2018	6.5%	6.25%	6.25%*	7.0%
2019	8.0%	8.0%	8.0%*	8.0%
2020	10.0%	10.0%	10.0%*	10.0%

*Standards for the Gasoline Only Case apply only to gasoline and gasoline substitute fuels only; diesel and diesel substitute fuels are exempted from any CI reductions under the alternative.

i. LCFS First Alternative: Gasoline Only Case

The California Trucking Association submitted this alternative to ARB. This alternative proposes removing the diesel standard from the LCFS proposal so that the regulation would achieve a 10 percent reduction in carbon intensity by 2020 from a 2010 baseline for gasoline and gasoline substitute fuels only. This alternative proposes no reduction in carbon intensity for diesel and diesel substitute fuels. This alternative is less stringent than the proposed regulation, as it would exempt nearly four billion gallons of transportation fuel from any CI-reduction requirements.

a. Benefits

This alternative is less stringent than the proposed regulation because it only reduces carbon intensity of gasoline and gasoline substitute fuels, but does not reduce the carbon intensity of diesel and diesel substitute fuels. The emissions reduction benefits of this alternative are lower than those associated with the proposed regulation.

b. Costs

At the assumed LCFS credit price of $100, this alternative would reduce the direct cost of compliance compared with the LCFS proposal because regulated parties would not be required to purchase credits for diesel. Excluding diesel and diesel substitute fuels from carbon intensity reduction standards is anticipated to decrease the cumulative number of credits that regulated parties must generate or purchase for compliance in 2016 through 2020 by 12.6 million credits.

c. Economic Impacts

The REMI model is used to look at the economic impact of the alternative. For employment, REMI shows slightly larger negative growth for the alternative compared with the combined LCFS/ADF proposal. Growth in GSP is higher for the reference case as well, which is predominantly driven by increased output projected in the model, likely due to an increasing alternatives market.

d. Cost-Effectiveness

The cost of complying with the gasoline only alternative is lower than the cost of complying with the LCFS proposal. The costs are lower for the alternative because it exempts diesel and diesel substitute fuels—approximately 20 percent of the transportation fuel market—from any carbon intensity reduction requirements. Excluding diesel and diesel substitutes, however, precludes the alternative from meeting the carbon intensity reduction goals of the proposed regulation.

e. Reason for Rejection

ARB rejects the gasoline only alternative because this alternative does not achieve the carbon intensity reduction goals of the proposed regulation. This alternative would only achieve a ten percent reduction in the carbon intensity of a portion of transportation fuels. This alternative results in carbon intensity reductions in the light duty fleet only, decreasing the incentive for innovation and investments in low-carbon fuel technologies. This alternative also results in increased emissions of greenhouse gas emissions from the transportation sector, and increased emissions of oxides of nitrogen and $PM_{2.5}$ when compared with the proposed regulation in all years analyzed.

ii. LCFS Second Alternative: Original CI Curve

This alternative proposes to maintain the cumulative GHG emission reduction benefits estimated for the 2010 LCFS such that the LCFS achieves a 10 percent reduction in the carbon intensity of transportation fuels by 2020 from a 2010 baseline. Compared with the 2010 LCFS, the LCFS proposal is anticipated to result in slightly lower GHG emissions reductions benefits by 2020 due to the Court decision to freeze the implementation of the 2010 LCFS at the 2013 carbon intensity standard during the re-adoption process, and because the LCFS proposal is less stringent than the 2010 standards from 2016 through 2018. To recover the lost GHG emissions reductions benefits, this alternative proposes setting the standards from 2016 through 2018 at more stringent levels than both the 2010 LCFS and the LCFS proposal. This alternative is more stringent than the LCFS proposal because it is requires more stringent reductions in carbon intensity from 2016 through 2018.

Table 11: Compliance Schedule: Original CI Curve Case

Year	Carbon Intensity for Gasoline and	Gasoline and Substitutes (Percent	Carbon Intensity for Diesel and	Diesel and Substitutes (Percent

	Substitutes (g/MJ)	Reduction)	Substitutes (g/MJ)	Reduction)
2016	94.43	5.0%	97.98	5.0%
2017	93.44	6.0%	96.95	6.0%
2018	92.44	7.0%	95.92	7.0%
2019	91.45	8.0%	94.89	8.0%
2020	89.46	10.0%	92.83	10.0%

a) Benefits

This alternative is more stringent than the LCFS proposal because the annual carbon intensity standards are more stringent from 2016 through 2018. This increased stringency is associated with increased benefits. This alternative also reduces the emissions of $PM_{2.5}$ and NOx compared with the LCFS proposal.

b) Costs

At the assumed LCFS credit price of $100, this alternative would increase the direct cost of compliance because conventional fuels will generate more deficits each year due to the increased stringency of the annual CI reductions required. This alternative is anticipated to increase the cumulative number of credits that regulated parties must generate or purchase for compliance.

c) Economic Impacts

For comparison, the REMI model is used to look at the economic impact of the alternative. For employment, REMI shows varying differences in employment growth for the alternative compared with the combined LCFS/ADF proposal. The alternative leads to large reductions in growth in early years, likely due to the increased stringency of the regulation in early years. Similarly for GSP, the combined LCFS/ADF proposal yields higher GSP growth changes in early years, and the alternative backloads the GSP growth. While REMI shows differences in the results for the alternative, this is likely not a discernable change from the business-as-usual.

d) Cost-Effectiveness

The cost of complying with the original benefits alternative are higher than the cost of complying with the LCFS proposal because the alternative sets more stringent annual carbon intensity reduction requirements than the proposed regulation in the early years (2016 – 2018). The original CI case alternative satisfies the carbon intensity reduction goal of the LCFS proposal—10 percent reductions by 2020 from a 2010 baseline—but achieves these goals at an increased cost; as such, it is less cost-effective than the ARB proposal.

e) Reason for Rejection

Although this alternative satisfies the 10 percent CI reduction by 2020 goal of the LCFS

proposal, ARB rejects the original benefits alternative because it achieves the CI reduction goal at a higher cost than the proposed regulation and reduces regulatory flexibility.

2. Alternatives Analyzed: ADF

ARB published a solicitation to stakeholders seeking public input regarding alternatives to the ADF proposal on July 29, 2014. The solicitation was sent by a list serve to stakeholders in an effort to reach as wide an audience as possible. ARB provided until August 15, 2014, as the deadline to receive responses to the solicitation. There were five responses to the solicitation: two requests for time extensions that were not feasible for the SRIA process timeline; one that suggested alternative wording for existing mitigation options that would not change the inputs into the economic analysis, but is currently under consideration for the final regulatory proposal; and two other alternatives that are considered below. Both of these alternatives were modeled using the REMI software consistent with the modeling that was applied to the proposed regulation.

They were modeled in REMI with the same assumptions as in the reference, but altering the direct compliance costs. The first alternative considered is one that could achieve additional benefits beyond those associated with the ADF proposal; it would lead to increased costs for consumers and result in smaller positive economic impacts. The second alternative considered is one that would not yield the same level of benefits as the ADF proposal.

i. ADF First Alternative: Submitted by Growth Energy

Growth Energy (GE) submitted an alternative to the ADF proposal in response to the solicitation for alternatives. The main differences between the ADF proposal and the GE alternative are listed below:

- GE proposes treating animal- and non-animal-based biodiesel the same: setting the significance level for both at zero percent, as compared to the ADF proposal, which sets the significance level at B1 for non-animal-based biodiesel and B5 for animal-based biodiesel.
- GE proposes eliminating the provisions for exemptions based on the use of NTDEs, as compared to the ADF proposal, which provides exemptions for biodiesel used in NTDEs.
- GE proposes eliminating the sunset provision of the ADF proposal, whereas the ADF proposal would likely end mitigation for biodiesel in 2024.

GE's alternative proposal retains the same mitigation options as the ADF proposal. Under the GE alternative, animal and non-animal biodiesel would be treated equally. Thus, RD would be blended with both animal and non-animal biodiesel at a ratio of 2.75:1 to mitigate NO_x emissions. For mitigation that uses additives, both animal and non-animal biodiesel would need to have one percent additive for a blend of 20% biodiesel (B20) blend to be mitigated.

a. Benefits

ARB finds that the GE alternative would meet the emissions goals of the ADF proposal and achieve roughly the same emissions benefits as the ADF proposal. The GE alternative may achieve marginally more emissions benefits if biodiesel were to be widely used as an additive under the ADF proposal. Although the GE alternative is simpler than the ADF proposal, the GE alternative is unnecessarily strict; ARB's analysis of the science does not find that there are NO_x increases with B5 animal biodiesel or biodiesel used in NTDEs, so requiring mitigation for these does not achieve any additional emissions benefit versus the ADF proposal.

b. Costs

The GE alternative would require mitigation of more fuel than the ADF proposal; regulated parties would incur more costs to mitigate non-animal- and animal-based biodiesel similarly and setting the significance level for both at one percent. Additionally, the NTDE exemption would increase the volumes of fuels to be mitigated, further increasing the direct costs on regulated parties.

c. Economic Impacts

The REMI results also indicate that the combined LCFS/ADF proposal has no discernible difference from the GE alternative. Employment, GSP, and output differ only slightly and represent a difference of less than one tenth of one percent. Given that the GE alternative has higher direct costs, the combined LCFS/ADF alternative is preferred.

d. Cost-Effectiveness

The GE alternative costs more than the ADF proposal, because it requires mitigation of more biodiesel than the ADF proposal. The GE alternative does not result in any more emissions reductions than the ADF proposal and as such is less cost effective than the ADF proposal.

e. Reason for Rejection

ARB rejects the GE alternative because it costs more than the ADF proposal and does not achieve additional emissions benefits.

ii. ADF Second Alternative: Submitted by National Biodiesel Board

The National Biodiesel Board (NBB) submitted an alternative to the ADF proposal in response to the solicitation for alternatives. The main differences between the ADF proposal and the NBB alternative are listed below:

- NBB proposes setting the significance level for biodiesel at 10% biodiesel blend (B10) for all biodiesel feedstocks.

- NBB proposes establishing an effective blend level that accounts for the impact of NTDEs, RD, and animal biodiesel, vs per-gallon mitigation in the ADF proposal.
- NBB proposes a three-year phase-in period for the regulation relative to no phase-in period in the ADF proposal. This yields a slightly higher per-year cost of infrastructure due to shorter amortization period (which is taken into account in the direct costs).

The NBB alternative would treat animal- and non-animal-based biodiesel the same by setting the significance level for both at 10 percent annually by volume. The NBB alternative includes a three-year phase-in period; accordingly, there are no costs for biodiesel mitigation in the first three years. For the NBB proposal, mitigation would not be necessary until the statewide biodiesel content is up to 10 percent. After the 10 percent threshold has been reached, any additional biodiesel would be mitigated in the same way as the ADF proposal.

a. Benefits

The NBB alternative has lower emissions benefits than the ADF proposal. Setting an effective blend level of B10 as the mitigation threshold means that mitigation is occurring on much less biodiesel, resulting in greater in NO_x emissions under the NBB alternative. However, since the NBB proposal could yield higher volumes of biodiesel than the ADF proposal, it may also lead to increased benefits from PM reductions.

b. Costs

Since mitigation is not required until biodiesel blend levels are much higher than under the ADF proposal, costs for mitigating biodiesel are reduced in the NBB alternative. Additionally, the proposed three-year phase-in period would reduce the costs to regulated parties in the early years of the regulation. Together, these provisions result in lower costs on regulated parties over the life of the regulation.

c. Economic Impacts

For comparison, the REMI model is used to look at the economic impact of the alternative. For employment and GSP, there is higher growth in early years for the alternative relative to the combined LCFS/ADF proposal.

d. Cost-Effectiveness

Although the NBB alternative does not implement mitigation until the statewide blend level reaches above 10 percent, once that threshold is reached, the mitigation options are the same as under the ADF proposal. Therefore the mitigation that does occur yields proportionally the same costs and emissions benefits as the ADF proposal, and as such, the cost effectiveness for the NBB alternative is the same as the ADF proposal.

e. Reason for Rejection

Because the NBB alternative achieves substantially less emissions benefits than the ADF proposal, does not meet the goals of the ADF proposal and ARB rejects the NBB alternative. However, ARB recognizes the difficulty in complying with a new fuel provision on biodiesel in the short term and recognizes that a phase-in period to allow regulated parties to accommodate changes to infrastructure and distribution networks, as well as certification of potential new mitigation options might be warranted if mitigation options are not entirely feasible on the effective date of a new regulation. Additionally ARB recognizes the potential for logistical difficulty in securing and implementing RD contracts brought up in the NBB alternative and is exploring alternative ways to utilize RD.

F. Fiscal Impacts

The impacts on state revenue will be based on state excise tax and sales tax on transportation fuels sold in California and the underground storage tank fee (UST) for stored petroleum products. California's excise tax, sales tax, and UST for gasoline and diesel are outlined in Table 12. These rates are used to identify the change in the taxes to state and local governments due to the combined LCFS/ADF proposal.

Table 12: State and Local Gasoline and Diesel Taxes[14]

State Taxes			
Gasoline		**Diesel**	
Excise	$0.36	Excise	$0.11
Underground Storage Tank Fee	$0.014	Underground Storage Tank Fee	$0.014
Other State Taxes/ Fees (Includes local taxes based on weighted average)	$0.119	Other State Taxes/ Fees (Includes local taxes based on weighted average)	$0.382
Sales Tax	2.25 %	Sales Tax	9.25 %

1. Local Government

Due to the increase in price of petroleum diesel under the combined LCFS/ADF proposal, there will be increases in the state revenue collected from sales tax. This will likely result in a net increase in local revenue for both the ADF and LCFS together. The magnitude depends on the credit price, compliance scenario chosen, and varies depending upon the tax rate in the locality. These changes are driven by increases in revenue from the State sales tax revenues generated from higher gasoline and diesel prices and increased volumes of renewable diesel.

[14] More information is available at: http://www.api.org/oil-and-natural-gas-overview/industry-economics/~/media/Files/Statistics/StateMotorFuel-OnePagers-Oct-2014.pdf

2. State Government

Under the LCFS/ADF proposal, shifting away from diesel and toward electricity, CNG, and other diesel alternatives will likely lead to a reduction in state excise tax collected on these transportation fuels sold in California, and less UST fees collected. However, due to the increase in the cost of petroleum diesel, there will be increases in the state revenue collected from sales tax. This will likely result in a net increase in state revenue for both the ADF and LCFS together; the magnitude depends on the credit price and compliance scenario chosen.

As with the local revenues, these changes are driven by increases in revenue from the state sales tax revenues generated from higher gasoline and diesel prices and increased volumes of renewable diesel. The revenues generated from excise taxes increase due to changes in the volumes of ethanol (and different types of ethanol), and increases in the volumes of renewable diesel.

3. ARB

The adoption of the LCFS/ADF proposal will not result in the need for increases to the ARB budget. There may be slight increases in staff hours required to monitor record-keeping and compliance. These slight adjustments are projected to be absorbed into the existing budget.

4. Other State Agencies

The primary impact of the proposal would be the changing prices on fuels. The fiscal impact will vary depending upon the types of fuels chosen.

Appendix A: Stakeholder Alternatives Received for LCFS

1. Various Alt-Fuel NGOs; June 18, 2014

a) Proposal

A group of stakeholders[15] support the LCFS as the best approach for meeting the carbon intensity reduction goals. They believe that the fuel-neutral performance standard is succeeding in spurring investment in technologies and fuels that diversify energy sources used in transportation. They reiterate that the alternative fuel market is now strong and encouraging competition in the fuel market, leading to increased choices for consumers.

b) Response

The LCFS proposal as-is meets this alternative suggestion and will be considered as the preferred regulation for implementation.

2. Sierra Research/ Growth Energy

a. Proposal

A group of ethanol producers submitted an alternative for consideration that proposes the LCFS be eliminated. The justifications indicated in their letter were that the GHG emissions can be achieved through the baseline due to the following programs:

- Federal Renewable Fuels Standard (RFS), which they indicate will achieve the GHG reductions at the tailpipe through increased biofuels and ethanol for blending with gasoline and blending of biodiesel and renewable diesel with conventional diesel.
- California-specific vehicle and engine-based regulations will be the main driver of electricity and hydrogen as transportation fuels. As for heavy-duty vehicles, the letter cites the California's Tractor-Trailer regulation (2008) and the heavy-duty regulations that will begin for the 2014 year, as the drivers of the changes in the diesel market.
- California's Cap-and-Trade program is indicated as another regulation that will drive GHG reductions. They indicate that any shortfall in emissions

[15] Signers of the letter include: Bonnie Holmes-Gen, **American Lung Association in California;** Russ Teall, **California Biodiesel Alliance** and **Biodico Sustainable Biorefineries;** Eileen Tutt, **California Electric Transportation Coalition;** Tim Carmichael, **California Natural Gas Vehicle Coalition;** John Boesel, **CALSTART;** Todd Campbell, **Clean Energy;** Harrison Clay, **Clean Energy Renewable Fuels;** Tim O'Connor, **Environmental Defense Fund;** Mary Solecki, **Environmental Entrepreneurs;** Shelby Neal, **National Biodiesel Board;** Simon Mui, **Natural Resources Defense Council;** Michelle Passero, **The Nature Conservancy;** Neil Koehler and Tom Koehler, **Pacific Ethanol;** Eric Bowen, **Renewable Energy Group, Inc.** and **California Biodiesel Alliance;** Jeremy Martin, **Union of Concerned Scientists;** Pete Price, **Waste Management**

reduction can be achieved through a modification of the Cap-and-Trade program.

b. Response

The proposed alternative assumes that the exclusive goal of the LCFS proposal is to achieve GHG emissions reductions without regard to source. If that were the case, this would be a viable alternative to the LCFS and would be assessed in this analysis. It is likely true that the estimated GHG emissions reductions appearing in the 2009 LCFS Initial Statement of Reasons ((California Air Resources Board, 2009)) could be achieved by the AB 32 Cap-and-Trade Program, along with the other programs cited by Sierra Research and Growth Energy. The LCFS proposal, however, was designed to address the carbon intensity of transportation fuels. Transportation in California was powered almost completely by petroleum fuels in 2010. Those fuels were extracted, refined, and distributed through an extensive and mature infrastructure. Transitioning California to alternative, lower-carbon fuels requires a very focused and sustained regulatory program tailored to that goal. The other regulatory schemes the alternative would rely on are comparatively "blunt instruments" less likely to yield the innovations fostered by the LCFS proposal. In the absence of such a program, post-2020 emissions reductions would have to come from a transportation sector that would, in all likelihood, have emerged from the 2010-2020 decade relatively unchanged.

In the absence of an LCFS designed to begin the process of transitioning the California transportation sector to lower-carbon fuels starting in 2010, post-2020 reductions would be difficult and costly to achieve. This is why the primary goals of the LCFS are to reduce the carbon intensity of California fuels, and to diversify the fuel pool. A transportation sector that achieves these goals by 2020 will be much better positioned to achieve significant GHG emissions reductions post-2020.

ARB is required to analyze only those alternatives that are reasonable and that meet the goals of the program as required by statute. An initial assessment of the program indicates the goals of the LCFS proposal can be achieved by keeping the program "…separate of the AB 32 Cap-and-Trade system initially (at least first 10 years) in order to stimulate innovation and investment in low-GWI [global warming intensity] fuel (or transportation) technologies."[16] Due to the strong justifications that the Cap-and-Trade program alone generates neither the CI reductions nor fuel in the transportation sector, this alternative will not be assessed in this document.

3. James Rhodes

a. Proposal

[16] A Low-Carbon Fuel Standard for California, Part 2: Policy Analysis - FINAL REPORT, University of California Project Managers: Alexander E. Farrell, UC Berkeley; Daniel Sperling, UC Davis. Accessed: 7-15-2015 http://www.energy.ca.gov/low_carbon_fuel_standard/

This letter proposes a regulation that is "…a technology-neutral, pure performance standard regulating lifecycle fuel carbon intensity." Mr. Rhodes indicates that a regulation that would meet this standard would be one that simplifies and streamlines implementation among other components.

Mr. Rhodes provides examples of cases in which he believes ARB now needs to make subjective judgments:

i. Innovative crude production: where innovative methods of crude production are eligible to generate credits.
ii. Refinery investment credits: where the refineries are eligible to generate LCFS credits after submitting a proposal that indicates their refinery is utilizing refinery-specific strategies to reduce their lifecycle CI.
iii. Bifurcated system of fuel classification: that provides conventional fuels (Tier 1) that have been long-time vetted to have set CI levels that are updated based upon average CI's of similar fuels (with similar processes) and new method fuels (which have not yet been evaluated over time) will be classified as Tier 2 and require additional evaluation from staff to ensure proper CI levels are assigned.
iv. Elements of the lifecycle assessments that require staff to specify different emission account methodologies for different fuels.

Mr. Rhodes proposal would minimize or eliminate these and similar cases, replacing them with a pure performance standard in which fuel CIs are determined strictly on the basis of standard life cycle analysis

b. Response

A purely technology-neutral performance standard, based only on standard life cycle analysis, would not meet the goals of the LCFS proposal. If the LCFS had the single goal of reducing the carbon intensity of transportation fuel, this alternative would be viable. A secondary goal of the program, however, is to stimulate innovations that lead to greater diversity in the fuel pool. In order to achieve both of these goals, some limitations must be placed on the use of life cycle analysis under the LCFS. Specifically, the use of certain categories of CI-reducing credits must be restricted. The credits in these categories can result in significant CI reductions without having any effect on the transportation fuel production process. Many Brazilian sugar cane ethanol plants, for example, earn a CI credit for the export of excess electricity co-generated using biomass boilers. These boilers burn "bagasse," the residue from the cane-crushing process. Burning bagasse produces more than enough thermal and electrical energy to power the plant. Exporting the excess electrical energy generated earns the plant a credit. If a plant proposes to acquire additional bagasse from neighboring plants—which may not be connected to the electrical grid—in order to generate and export additional electricity, we would have to disallow the use of the resulting increased exports as a credit. Similar types of credits that have no impact on fuel production must also be disallowed. Although such credits would reduce the fuel pathway CI, they do not produce the kinds of innovations that lead to diversification of the fuel pool.

4. California Trucking Association

a) Proposal

i. Reduce program costs to consumers by permitting unlimited 2-way allowance trading between Cap and Trade and LCFS programs.

ii. Reduce program costs to consumers by allowing the use of allowance offsets in the LCFS program at the rate of 8 percent, just as is allowed in the Cap and Trade program.

iii. Lower the cost to consumers for reducing carbon in fuels by discontinuing the LCFS program and relying solely on the Cap and Trade program. Or, alternatively do not include transportation fuels under the Cap in the Cap and Trade program.

iv. The economic alternative to be assessed here is the cost savings for consumers of a program change to anticipatorily reduce the program's annual requirements to conform them to expected supplies. This would require adopting procedures, comparable to those employed by EPA, setting annual alternative fuels requirements for the LCFS based upon annual forecasts of alternative fuels availability

v. Assess the alternative of removing diesel from the LCFS program.

vi. Evaluate the alternative of imposing a carbon tax to replace the LCFS and Cap and Trade programs.

vii. Assess the alternative of imposing LCFS and/or Cap and Trade program costs at the fuel pump as tax-exempt regulatory surcharges.

Note: CTA's submission also included alternative assumptions for price and economic variables, with a suggestion that they be used in lieu of the Department of Finance forecast.

b) Response

If regulated parties (RPs) were allowed to meet their LCFS obligation using Cap-and-Trade allowances, and no compensating changes were made to the structure of the program, the effect would be similar to the alternative suggested by Sierra Research and Growth Energy: eliminating the LCFS and allowing the GHG emissions reduction goals of the state to be met by the Cap-and-Trade program. This effect would occur because RPs would be able to meet their compliance obligations through retiring allowances, in addition to retiring LCFS credits and producing low-CI fuels. This additional compliance mechanism would significantly reduce the incentive that now exists under the LCFS to comply by actually bringing new low-carbon-intensity (CI) fuels to market. If this alternative were to achieve the stated goals of the program (as articulated in the response to Sierra Research and Growth Energy, above, a compensating adjustment would have to be made in the LCFS's compliance curve to offset any reduction in the regulation's incentive to actually bring new low-CI fuels to market. This compensating revision would result in a program that would create the same fuel cost impacts as the current program. No justification exists for increasing the complexity of the program without obtaining any tangible benefit.

i. The effect of allowing allowance offsets to be used in the LCFS program would be similar to allowing the use of allowances themselves. In order to achieve the stated goals of the program after allowing allowance offsets to be used for compliance, the compliance curve would have to be adjusted to accommodate this additional compliance mechanism. As in the previous response, this would introduce increase complexity without producing any tangible benefits.

ii. Part One of this alternative is identical to the alternative suggested by Sierra Research and Growth Energy, and is not analyzed for the reasons articulated above in response to the Sierra Research/Growth Energy proposal. Part Two of this proposed alternative is not viable because it would reduce the ability of the Cap-and-Trade program to meet its near-term goals, and severely undercut the program's ability to meet the longer-term GHG emissions reduction goals. This is because roughly 40 percent of GHG emissions are generated in the transportation sector, and because the transportation sector presents significant GHG-emission-reduction challenges (as articulated in the ARB response to the Sierra Research/Growth Energy proposal, above).

iii. If the LCFS compliance obligation were based only on projections of actual fuel availability, the goals of the program would be more difficult to meet. Achieving the CI-reduction and fuel diversification goals of the program depend upon the creation of financial incentives to bring ***additional*** supplies of low-CI fuels to market. If the compliance targets only reflect the supplies that would be expected in the absence of those incentives, LCFS credit prices would hover in the $0 range, and no additional financing would be available to developers of new low-CI fuel supplies. Unless the LCFS can provide incentives for the production of low-CI fuel supplies ***above and beyond*** those that would have occurred in the absence of the program, it will not achieve its CI-reduction and fuel-diversification goals. The LCFS is fundamentally an incentive program. If compliance can be achieved with available supplies, there is no incentive to increase the supply of low-CI fuels required to meet the carbon intensity reduction goals of the LCFS.

iv. The goals of the program are, as articulated in the response the Sierra Research/Growth Energy proposals above, to reduce the carbon intensity of the California transportation fuel pool by 10 percent by 2020, and, in so doing, to diversify that fuel pool. Diesel fuel comprises 21 percent of the transportation fuel consumed in California. Exempting that 21percent of the fuel supply from the LCFS regulation would be inconsistent with the stated goals of the program. In addition, many of the important new low-CI fuels that the program seeks to incentivize are substitutes for petroleum diesel fuel.

v. A carbon tax imposes a financial penalty on every unit of GHG emissions generated. If the tax is high enough, an incentive to displace high-CI with low-CI fuels is created. Because the demand for petroleum fuels is strongly inelastic, however, the tax would have to be quite high—would have to impose painful burdens on California consumers—before petroleum fuel producers would begin to invest in lower-CI fuels rather than pass additional costs on to consumers. By incenting low-CI fuels rather than directly penalizing high-CI fuels, the LCFS

creates a lower-cost pathway to CI reductions and fuel diversification than the carbon tax. A significant tax on fuels that does not differentiate between lifecycle CI could simply result in less economic activity without encouraging innovation in fuel types and production methods. Unlike the proposed regulation, simply shrinking the economy does not provide for a low carbon and prosperous California after 2020.

A regulatory surcharge imposed at the pump is the functional equivalent of a carbon tax. The previous item develops the rationale for rejecting a carbon tax as a viable alternative to the LCFS.