

PROPOSED ERRATA

DRAFT STATE ALTERNATIVE FUELS PLAN

October 19, 2007

New Text is Underlined

Executive Summary

Page ES-1, add to paragraph 1, third sentence

A reasoned and well planned transition to a diversified alternative transportation future can be a critical step toward achieving California's goals of reduced petroleum dependence and improved energy security, reduced GHG emissions, in-state biofuel production and use, and improved air quality.

Page ES-1, add new after paragraph 4

The State Plan presented in this report meets the requirements of Assembly Bill 1007 (Pavley, Chapter 371, Statutes of 2005) to develop and adopt a plan to increase the use of alternative fuels without adversely affecting air quality or water quality, or causing negative health effects. The Plan is presented as an alternative fuels goal coupled with a series of implementing requirements. These implementing requirements include such provisions as the Low Carbon Fuel Standard, financial incentives authorized by the recent signing of Assembly Bill 118 (Nunez, Chapter Statutes of 2007), policy recommendations for the affected State agencies, and a summary of actions that can be taken by the industry itself to innovate and promote alternative fuel use and production.

While this Plan focuses on transportation fuels, and alternative fuels in particular, as required by AB 1007, other components of the transportation system, including advanced vehicle technology and efficiency improvements in conventional vehicles, are key elements needed to achieve our state's petroleum reduction, air quality and climate change goals. In addition, significant efforts are needed to reduce vehicle miles traveled by all Californians through more effective land use and transportation planning and greater mass movement of people and goods.

Page ES-3, paragraph 1, first sentence

Change 9.3 million to 0.93 billion

Page ES-3, paragraph 2, first sentence, add

to produce energy before electricity, biomethane (natural gas) and biofuels.

Page ES-3, paragraph 2 after the final sentence, add

Using materials from our state's agricultural, forestry, and urban waste streams to produce energy improves forest and animal health, reduces the risk of catastrophic wildfires, and reduces the volumes of landfill wastes. Biomass-based fuels should be pursued as one of our state's top priorities for achieving the Low Carbon Fuel Standard.

Page ES-3, after paragraph 3 before "Legislative Requirements," add

Air Quality Goals: Over 90 percent of Californians breathe unhealthy air at times. Both the United States Environmental Protection Agency (U.S. EPA) and the CARB have established ambient air quality standards for regional ozone and particulate matter. The air quality goal is to achieve these standards.

Air quality modeling indicates that significant reductions in key pollutants are needed to achieve the ozone and PM_{2.5} standards. To achieve these federal standards, both the San Joaquin Valley Unified Air Pollution Control District and the South Coast Air Quality Management District must develop State Implementation Plans (SIPs). The ozone SIPs will be submitted to the U.S. EPA in the fall of 2007, followed by submittal of the PM_{2.5} SIPs in the spring of 2008.

Page ES-3, bullet 2 and 3 under "Legislative Requirements"

- Evaluate alternative fuels using a full fuel cycle analysis of emissions of criteria air pollutants, air toxics, greenhouse gases, water pollutants and other substances that are known to damage human health.
- Set goals to increase alternative fuels in 2012, 2017, and 2022, that ensure that there is no net material increase in air pollution, water pollution, or any other substances that are known to damage human health.

Page ES-4, first paragraph under “Plan Conclusions,” after the first sentence, add

The Plan also concludes that meeting the state’s long term goal of reducing GHG emissions to 80 percent below the 1990 level will require a multi-faceted approach, including increased use of alternative fuels, significant improvements in the energy efficiency of the vehicle fleet, and reducing trips and vehicle miles traveled through changes in travel habits and land management policies.

Page ES-4, after the second paragraph, last sentence, add

The Plan depends on private capital investment, financial incentives, and technology advancement and innovation. The Plan identifies the potential for steady and substantial growth in the use of many alternative fuels, the mix of which will change and evolve over the near term (2007-2015), mid term (2016-2030) and long term (2031-2050).

Page ES-4 add to the third paragraph

Sustained and properly targeted federal incentives, augmented by state incentives, will be needed to complement policy mechanisms, mandates, standards, and regulations. All of these mechanisms should be maintained in a consistent manner over an extended period.

Page ES-4 add to fourth paragraph, after the second sentence

advantages over conventionally produced gasoline and diesel fuels in that regard.

Page ES-4 add after last sentence

However, the full fuel cycle analysis will need to be refined and updated to address sustainability issues and land use conversion impacts of biofuels.

Page ES-4 add to first sentence fifth paragraph

Biofuels are a good option in the short term because they are available now and have petroleum reduction, waste reduction, and climate change benefits. The state should encourage and support the in-state production of these fuels from the state’s agricultural, forestry and urban waste residues.

Page ES-4 add to the first sentence of the sixth paragraph

Lastly, the Plan concludes that a five-part strategy is needed:

Page ES-5 add after part 4 of sixth paragraph

(5) most important for the mid to long term, achieve the maximum feasible improvements in vehicle efficiency to the total energy needed to power transportation in California.

Page ES-5 add to seventh paragraph

It is not possible to accurately predict the fuel mixes and proportionate market share each alternative fuel will eventually realize. All of the alternative fuels evaluated during development of this Plan have the potential for expanded use, and are included in the projections on how California can shift to a sustainable mix of future transportation fuels. The Plan presents three illustrative examples of fuel combinations, which include a mix of fuel options to demonstrate that the ambitious alternative fuel use goals are achievable. These examples also form the basis for establishing the alternative fuel use goals for 2012, 2017, and 2022, as called for in AB1007.

Page ES-5, changes to “Goals and Outcomes”

The plan was developed with the objective of achieving the following goals and outcomes.

- Define the actions needed to diversify the state’s transportation fuel supply while concurrently reducing the total amount of energy needed to power the transportation sector.
- Set alternative transportation fuel use goals, designed to ensure that there is no net material increase in air pollution, water pollution, or any other substances that are known to damage human health.
- Surpass California’s existing 2020 and 2030 goals to increase the use of alternative transportation fuels under all three moderate case portfolio mixes.
- Ensure no net increase in criteria and toxic air pollutants occurs under the Plan.
- Ensure that implementation of the Plan will not interfere with the state’s commitments, under the State Implementation Plan, to improve air quality and achieve ambient air quality standards.
- Increase the use of renewable and sustainable alternative fuels, on a full fuel cycle basis, compared to petroleum fuels, to achieve the potential to lower the overall carbon intensity of California’s transportation fuel pool through the implementation of the state’s Low Carbon Fuel Standard.
- Adopt and implement the Low Carbon Fuel Standard to help achieve the transportation sector’s proportional share of the greenhouse gas reductions and to provide a durable framework for the use of low-carbon alternative fuels and stimulate technology innovation.

- Ensure that vehicles operating on alternative fuels comply with motor vehicle emission standards.

Page ES-5, add “Specific Findings” after the last paragraph of the “Goals and Outcomes” section

Specific Findings

The following sections outline the key findings that underlie the Plan and the recommendations for its implementation.

Page ES-5 and 6, changes to bullets under “Fuels”

Fuels

- A number of different analyses were done that looked at the penetration of various alternative fuels into the transportation fuel sector. These analyses were done using the best available full fuel cycle analysis methodology. A moderately aggressive analysis shows that ambitious but plausible goals for displacing traditional gasoline and diesel can be achieved. These goals, expressed on a gallon of gasoline equivalent basis, are presented below:
 - 9 percent in 2012;
 - 11 percent in 2017; and
 - 26 percent in 2022.
- With these goals, the Plan accelerates the growth of alternative fuels, displacing more than 4 billion gasoline gallon equivalents (20 percent) in 2020. This could grow to at least 30 percent by 2030. By 2050, alternative fuels could provide more than half the energy needed to power California’s transportation system.
- Primary biofuels include ethanol, biodiesel, renewable diesel, and biomethane produced from agricultural, forestry and urban wastes and other renewable feedstocks.
- Biodiesel and renewable diesel, natural gas, propane, and electric drive technologies are primary options to displace diesel fuel in markets, such as transit buses, school buses, delivery vans, truck refrigeration units, and port vehicles.
- Natural gas use in heavy-duty vehicles alone could represent about 36 percent of the freight and off-road vehicle fuel use by 2050.

Page ES-6, changes to bullets under “Vehicles”

- Advanced biofuels could be used in conventional vehicles; and flexible fuel, plug-in hybrid electric, and fuel cell vehicles could increase to 5 million vehicles in 2020 and to more than 35 million in 2050 (over 75 percent of all vehicles operating in California).
- Light-duty diesel vehicles will enable the use of renewable diesel and biodiesel in the light-duty vehicle fleet.

Page ES-6, bullet 1 under “Market Niches”

- Biodiesel and renewable diesel, natural gas (including from biomethane)...

Page ES-6, bullets 1 under “Government Actions”

- Mandates alone will not achieve the single policy goals outlined or multiple goals as a group. While the low carbon fuel standard can achieve a substantial percentage of the greenhouse gas reduction needed from the transportation sector, it is clear that complementary government actions are needed to fully achieve the state’s 2020 and longer term reduction goals.

Page ES-7, add to bullet 4 under “Government Actions” after the first sentence

- These estimates are based on capital cost assumptions, technology research and development needs, infrastructure requirements, manufacturing investments and consumer education program cost estimates.

Page ES-7, under “Costs,” add

- Biofuels from California’s waste streams would be even more cost-effective, if the waste treatment costs were considered in the analysis, and savings from avoiding these costs would improve the economics of these fuels.
- All of the alternative fuel mixes shown in the illustrative case examples in Chapter 5, are cost-effective in achieving petroleum reduction and GHG reduction goals by 2050, or even earlier.

Page ES-8, paragraphs 3 and 4 under “Plan Scope,” add after the bullets

The XTLs cover a broad range of fuel production technologies. Some of these technologies are commercially available today; others are in development. While XTLs offer attractive alternative feedstocks, GTL from flared natural gas offers positive benefits on a global basis, and BTLs, liquid fuels produced from biomass sources, have a lower carbon footprint than other XTL fuels. To play a major role in meeting plan goals, however, innovation and cost reductions will be required.

Page ES-8, change paragraph 4

The Plan recommends targets of 9 percent in 2012, 11 percent in 2017, and 26 percent in 2022. The Plan also presents a “2050 Vision” that extends the Plan outcomes beyond the milestone years 2012, 2017, and 2022, and lays a plausible foundation for building a potential multi-fuel transportation energy future scenario for California by 2050. The 2050 Vision anticipates improvements in vehicle efficiency, reductions in energy demand due to improved travel habits, and the widespread use of low GHG-emitting fuels. As a result of these strategies, the 2050 Vision presents a transportation future that greatly reduces the energy needed for transportation, provides that energy through a diverse set of transportation fuels, eliminates over dependency on oil, and achieves an 80 percent reduction in GHG emissions.

Page ES-9, under “Recommended Actions,” add

The Committee recommends that the Energy Commission adopt the Alternative Fuels Plan presented in this report. The Committee also recommends that the Energy Commission work in partnership with CARB and other appropriate agencies to implement the Alternative Fuels Plan. Specific additional actions are recommended as listed below.

Page ES-9, under “Recommended Actions,” add after the second sentence of the first existing paragraph

The Alternative Fuels and Vehicle Technologies Funding Program legislation (AB 118, Nunez, Statutes 2007) proactively acts on this recommendation. The Energy Commission and the Air Resources must act to leverage the funds provided under AB 118 to achieve the Plan goals.

Use of California’s urban, agricultural and forestry wastes to produce energy and fuels should be aggressively pursued.

Page ES-9, under “Recommended Actions,” add after first sentence, second paragraph

The Low Carbon Fuel Standard will be critical to establishing the framework for the use of alternative fuels.

Third paragraph, remove “aggressive” from third sentence

Page ES-9, add to the end of “Recommended Actions”

In implementing the plan, the focus on achieving all of the goals should be considered. This includes reducing the dependency on petroleum, reducing greenhouse gases, encouraging in-state biofuels production and use, and meeting ambient air quality standards.

Page 6, Chapter 2, add the following sentence to the end of paragraph 4

The examples show that the Plan’s alternative fuel use goals of 9 percent in 2012, 11 percent in 2017, and 26 percent in 2022 are achievable.

Page 10, Chapter 2, bullet 1 under “Key Conclusions of the Plan,” add after second sentence first comma

- provide substantial reductions in petroleum use by 2020, and provide a durable framework for the production and use of alternative fuels, additional actions are necessary to achieve the stated goals.

Page 10, Chapter 2, add the following bullets under “Key Conclusions of the Plan”

- Meeting the state’s long term goal of reducing GHG emissions to 80 percent below the 1990 level will require a multi-faceted approach, including increased use of alternative fuels, significant improvements in the energy efficiency of the vehicle fleet, and reducing trips and vehicle miles traveled through changes in travel habits and land management.
- The alternative transportation fuel use goals are designed to ensure that there is no net material increase in air pollution, water pollution, or any other substances that are known to damage human health.
- Implementation of the Plan will not interfere with the state’s commitments, under the State Implementation Plan, to improve air quality and achieve ambient air quality standards.
- Light-duty diesel vehicles will enable the use of renewable diesel and biodiesel in the light-duty vehicle fleet.

Page 11, Chapter 2, after paragraph 1 add the following paragraph under “Recommended Government Actions”

The Committee recommends that the Energy Commission adopt the Alternative Fuels Plan presented in this report. The Committee also recommends that the Energy Commission work in partnership with CARB and other appropriate agencies to implement the Alternative Fuels Plan. Specific additional actions are recommended as listed below.

Page 12, Chapter 2, bullet 1 under California Air Resources Board

- Establish regulations for a Low Carbon Fuel Standard to meet or exceed the Governor’s carbon intensity goal for transportation fuels with consideration for California’s petroleum reduction goals, in-state Bioenergy Action Plan goals, and sustainability of alternative fuels. The Low Carbon Fuel Standard will establish a durable framework for the production and use of alternative fuels.

Page 27, Chapter 3, under “The Future Value of the Full Fuel Cycle Assessment” add the following sentence to the last paragraph

The full fuel cycle analysis will need to be refined and updated to address sustainability issues of current and future production of biofuels.

Page 28, Chapter 4, under “Multiple State Policies” add the following bullet

- **Air Quality Goals:** To attain the State and federal ambient air quality standards consistent with the State Implementation Plan.

Page 30, Chapter 4, before Table 2, add the following section and paragraphs

Air Quality Goals

Over 90 percent of Californians breathe unhealthy air at times. Both the United States Environmental Protection Agency (U.S. EPA) and the CARB have established ambient air quality standards for regional ozone and particulate matter. The air quality goal is to achieve these standards.

Air quality modeling indicates that significant reductions in key pollutants are needed to achieve the ozone and PM_{2.5} standards. To achieve these federal standards, both the San Joaquin Valley Unified Air Pollution Control District and the South Coast Air Quality Management District must develop State Implementation Plans (SIPs). The ozone SIPs will be submitted to the U.S. EPA in the fall of 2007, followed by submittal of the PM_{2.5} SIPs in the spring of 2008.

Page 32, Table 4, change title to Alternative Fuel Use Results

Page 32, Chapter 4, change paragraph 1 under Table 4 to

The XTLs cover a broad range of fuel production technologies. Some of these technologies are commercially available today; others are in development. To play a major role in meeting plan goals, however, innovation and cost reductions will be required.

Page 32, Chapter 4, add the following sentence to the paragraph 2 under Table 4

The examples show that the Plan's alternative fuel use goals of 9 percent in 2012, 11 percent in 2017, and 26 percent in 2022 are achievable.

Page 54, Chapter 5, change paragraph 1 under "Example Analysis Summary" first sentence

The example analysis shows what the contribution of alternative fuels could be in meeting the Plan's alternative fuel use goals of 9 percent in 2012, 11 percent in 2017, and 26 percent in 2022.

Page 64, Chapter 7, add the following footnote after the title of Table 10

29 - The capital costs in this table should not be added directly to obtain a total capital cost for each fuel, because the privately funded portion of the R&D cost is likely to be recovered in the vehicle price.

Page 66, Chapter 7, under "Societal Cost-Effectiveness Analysis" change paragraphs 4, 5, and 6

The three alternative fuel examples are described in detail in Chapter 5 of this plan. In brief: in Example 1, ethanol continues to be used as a gasoline blendstock in the future, both as E85 (for use in flexible fuel vehicles) and in low-level blends. Light-duty hydrogen fuel cell vehicles dominate the alternative vehicle market. This example also includes natural gas, propane, and renewable diesel fuels, as well as plug-in hybrid electric vehicles.

Example 2 is similar to Example 1, except that (1) hydrogen fuel cell vehicles do not achieve market success, and plug-in hybrid electric vehicles dominate the light-duty alternative vehicle market; and (2) an advanced biofuel is developed and replaces ethanol as a gasoline blendstock.

Example 3 is a hybrid of Examples 1 and 2. It assumes that both hydrogen vehicles and the advanced biofuel achieve market success.

Figure 17: Cost-Effectiveness Range for Example 1

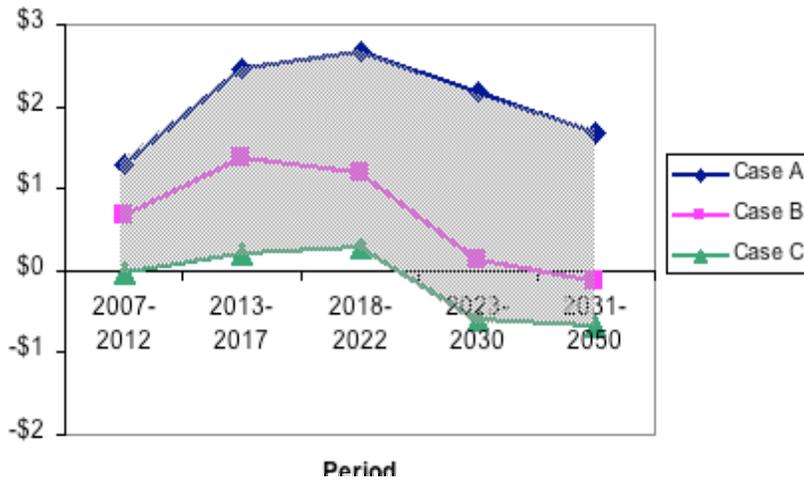


Figure 18: Cost-Effectiveness Range for Example 2

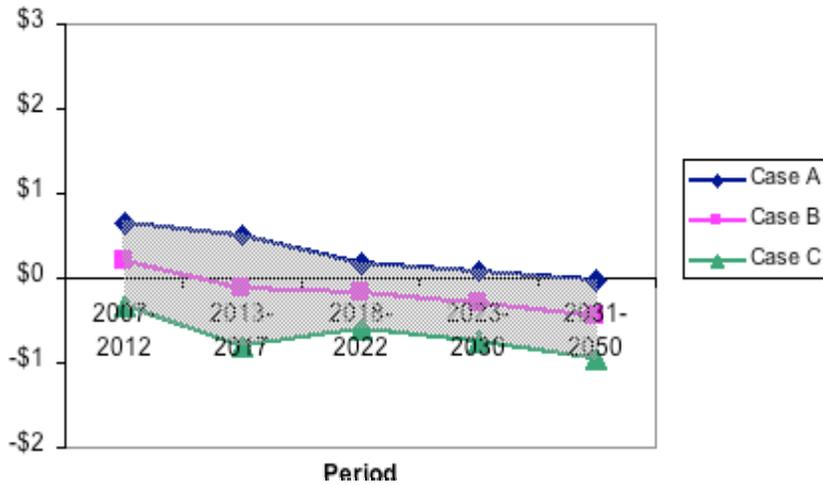


Figure 19: Cost-Effectiveness Range for Example 3

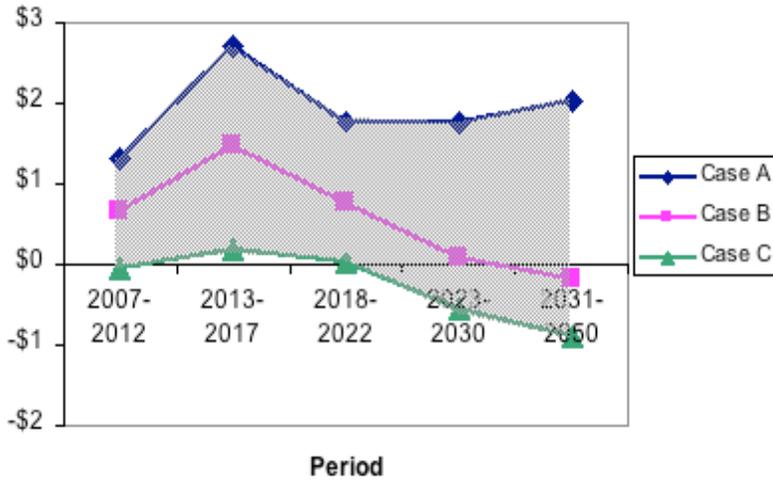
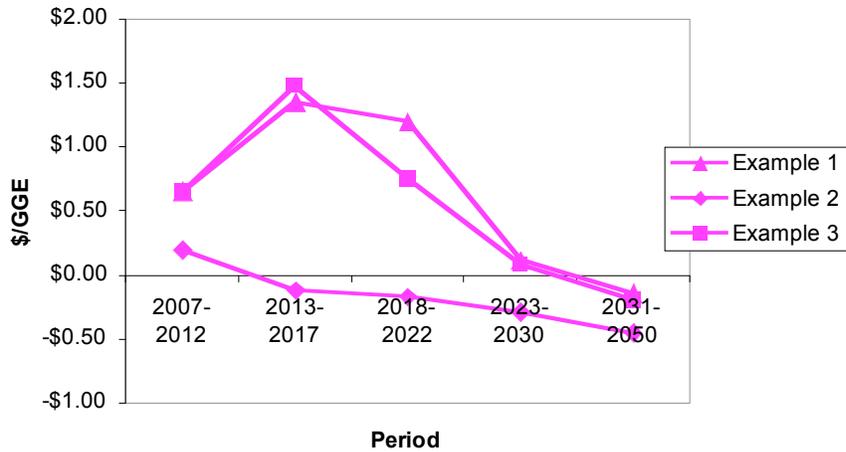


Figure 20: Cost-Effectiveness of All Examples, Medium Cost Projections



Page 70, Chapter 7, change Table 12

Table 12: Cost-Effectiveness of Petroleum Reduction (2007\$/GGE)

	2007-2012	2013-2017	2018-2022	2023-2030	2031-2050
Hydrogen	\$13.40 to \$34.80	\$13.30 to \$32.80	\$10.40 to \$28.20	\$1.40 to \$18.90	-\$1.00 to \$10.90
Electric Drive	\$12.60 to \$19.20	-\$0.10 to \$4.70	-\$2.40 to \$1.60	-\$2.80 to \$0.90	-\$2.70 to \$0.90
Renewable Diesel	\$1.60 to \$2.00	\$1.50 to \$1.90	\$1.40 to \$1.90	\$1.30 to \$1.80	\$1.00 to \$1.50
Ethanol	\$0.65 to \$0.90	\$0.33 to \$0.63	\$0.18 to \$0.47	-\$0.08 to \$0.17	-\$0.01 to \$0.17
Propane	\$0.14 to \$0.29	-\$0.01 to \$0.33	-\$0.03 to \$0.32	-\$0.04 to \$0.30	\$0.08 to \$0.32
Natural Gas	-\$2.00 to -\$1.00	-\$2.60 to -\$0.90	-\$2.70 to -\$1.10	-\$2.70 to -\$1.10	-\$2.20 to -\$0.90
Advanced Biofuel			-\$0.25 to \$0.06	-\$0.26 to \$0.06	-\$0.22 to \$0.05

Page 70, Chapter 7, change Table 13

Table 13: Cost-Effectiveness of GHG Emissions Reduction (2007\$/tonne CO₂)

	2007-2012	2013-2017	2018-2022	2023-2030	2031-2050
Hydrogen	\$1,700 to \$4,200	\$1,600 to \$3,900	\$1,100 to \$3,000	\$190 to \$1,900	-\$66 to \$1,100
Electric Drive	\$1,800 to \$2,700	-\$30 to \$370	-\$190 to \$160	-\$220 to \$82	-\$220 to \$98
Renewable Diesel	\$200 to \$200	\$170 to \$170	\$140 to \$150	\$130 to \$130	\$96 to \$97
Ethanol	\$250 to \$290	\$120 to \$140	\$85 to \$110	\$22 to \$49	\$33 to \$60
Propane	\$160 to \$230	\$64 to \$260	\$53 to \$260	\$45 to \$240	\$140 to \$281
Natural Gas	-\$470 to -\$250	-\$590 to -\$210	-\$630 to -\$260	-\$630 to -\$260	-\$530 to -\$210
Advanced Biofuel			\$13 to \$23	\$13 to \$22	\$11 to \$19