DOCKETED	
Docket Number:	20-IEPR-02
Project Title:	Transportation
TN #:	235195
Document Title:	Mightycomm Comments - Proposed Chapter on Liquid Fuels
Description:	N/A
Filer:	System
Organization:	Mightycomm
Submitter Role:	Public
Submission Date:	10/9/2020 3:39:12 PM
Docketed Date:	10/9/2020

Comment Received From: Mightycomm
Submitted On: 10/9/2020
Docket Number: 20-IEPR-02

Proposed Chapter on Liquid Fuels

Attached is a proposed chapter dealing with the role of low carbon liquid fuels in advancing the state's goals of greenhouse gas and criteria pollutant reduction.

Additional submitted attachment is included below.

2020 EIPR Update Liquid Fuels Chapter

Preamble

The California Energy Commission's purpose of the Integrated Energy Policy Report is to the point:

> *California's economy depends on affordable, reliable, and environmentally sound supplies of electricity, natural gas, and transportation fuels. The challenge for California's policy makers is to manage an energy sector that is shifting away from oil and natural gas and moving to a sustainable future with renewable energy resources and alternative transportation vehicles.*

To fulfill that mission, it is critical that the IEPR address California's transportation fuel mix comprehensively in its annual assessment in order to have an information baseline from which to assist the state in its transportation policy decisions. While the state seeks alternatives to fossil fuels, it needs to have a full assessment of what the task ahead entails, i.e.: What are the current inventories, markets for and uses of fossil fuels for transportation? Only with that baseline information can a clear pathway be laid out that moves the state toward its eventual goals.

Transportation Fuels

Introduction

The stated goal of the CEC in transportation is to:

"Promote development and deployment of advanced transportation technology, including alternative and renewable fuels, vehicles, technologies, and infrastructure, to help the state achieve its energy security, petroleum reduction, clean air, and greenhouse gas reduction goals."

Even the most rapid transition to an electrified transportation system envisioned by the state indicates that tens of millions of light-, medium- and heavy-duty vehicles will continue to be fueled for decades by liquid and gaseous fuels in addition to other innovative, low-carbon fuels in development or in the lab. To secure GHG reductions and air quality improvements in the gap between the present and a future date – when zero-emission vehicles may be the predominant transportation mode – California needs to focus on innovative, low-carbon fuels that can deliver immediate health and environmental benefits to the state and its residents.

The California Air Resources Board lays out the state's GHG reduction strategy in its 2017 Scoping Plan[1], declaring that one of the key tenants carrying over from the original program is:

- Production of increased volumes of clean, renewable fuels.

Other parts of the Scoping Plan call for an increasing dependence on renewable energy and "slashing" potent GHG super-pollutants from dairies, landfills and refrigerants. Converting those super-pollutants to transportation fuels is a state policy enshrined in SB 1383[2], and currently being implemented by the CDFA, CARB and CEC. While these fuels could be low-carbon electricity and/or renewable hydrogen, there are other transportation fuels that might fill the gap until zero-emission vehicles are plentiful enough to justify exclusive production and use for ZEVs.

This is but one example of the role innovative, low-carbon liquid and gaseous fuels can play in achieving the CEC's stated goals for near-zero emissions transportation.

Background

Currently, California's transportation sector continues to be heavily dependent on petroleum-based fuels for the movement of people and goods across the state, and these petroleum-based fuels contribute to the largest source of the state's total carbon emissions. Governor Newsom acknowledges this significant impact in his Executive Order N-19-19, which notes that, "in recent years, direct tailpipe emissions from cars, ships, diesel trains, airplanes, and other transportation sources have remained a stubborn driver of greenhouse gas emissions, totaling 40.1 percent of all greenhouse gas emissions statewide…."[3]

The Governor's press release announcing the Executive Order also noted: "Medium- and heavy-duty diesel trucks make up only 4 percent of the 28.2 million vehicles on the road in California but accounted for 20 percent of greenhouse gas emissions from the transportation sector and 8 percent of statewide greenhouse gas emissions this year. Cars, trucks and other vehicles are responsible for more than 80 percent of smog-forming pollution."

Similarly the CEC noted in its 2018-2019 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program (now known as the Clean Transportation Program) that 91 percent of the roughly 29.8 million vehicles in the state rely exclusively on either gasoline or diesel for fuel[4].

In its 2019-2020 Investment Plan Update, that percentage only declined to 89%. Revealingly, however, both updates make a point of stressing that any low-carbon substitute fuel that can displace the roughly 13.9 billion gallons of gasoline and 3.3

[1] https://ww3.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf
[2] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383
[3] https://www.gov.ca.gov/wp-content/uploads/2019/09/9.20.19-Climate-EO-N-19-19.pdf
[4] Page 62

billion gallons of diesel used per year in California can provide both an immediate and long-term opportunity to reduce GHG emissions and petroleum fuel use[5].

This remains true today and might still for many years absent a rapid and unforeseen uptake of electric vehicles across the passenger and commercial vehicle sectors. As such, inclusion of fuel inventories and analyses for these fuel types is essential for there to be a baseline understanding of what electric vehicles would be replacing.

Current Conditions

Pure-electric light-duty vehicle sales in California represented a total of slightly more than 100,000 new cars sales in 2019 out of statewide sales of almost 2 million new cars and trucks (~5%). Providing alternatives to petroleum-based fuels has the chance to significantly and rapidly reduce the billions of gallons of gasoline and diesel used annually in California by the other ~95% of the cars and trucks, as well as immediately reduce both GHGs and criteria pollutants.

As of the first half of 2020, California is spending more than $200 million per year on light-duty, zero-emission vehicle rebates. According to projections from the Center for Sustainable Energy (CSE) – administrator of the Clean Vehicle Rebate Program (CVRP) – this program would need an additional $921 million over the next three years to meet expected demand. To reach the state's goal of 5 million ZEVs by 2030, CSE estimated the CVRP would need $5.6 billion in additional funding.

In addition, the state's Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project (HVIP), which is currently oversubscribed for its 2019-20 budget of $142 million, projects needs of at least $200 million per year in future years to keep up with demand for new medium and heavy-duty ZEVs as the state strives to meet a goal of 100,000 HD ZEVs by 2030.

The amount of funding necessary for both of these programs creates a daunting timeline and budgetary lift, even during the best of economic times, for the acceleration of adoption of ZEVs.

California has built its success in GHG reduction and criteria pollutant reduction on the willingness to embrace new technologies and innovative strategies. Using innovative, low-carbon transportation fuels as an interim step to move the state forward is a logical extension of past policy.

The Air Resources Board has passed its Advanced Clean Truck regulation, which mandates truck manufacturers to produce increasing percentages of new zero emission trucks and offering them for sale. As part of the discussions of the regulation, CARB is developing regulations to require truck fleets to purchase a percentage of electric

[5]2018-2019 Update, Page 62; 2019-2020 Update, Page 74

vehicles, a rule that is expected to come online in a parallel timeframe to the manufacturing regulation.

However, even with those regulations, the approximately 1 million medium- and heavy-duty trucks currently on the road will be in operation for decades. Per SB 1, any new vehicle sold with an emissions-compliant engine that runs on fossil fuel will be allowed to remain in service for 18 model years. This means, even with the new regulation, diesel or gasoline-fueled trucks will remain in operation for more than a decade and a half after the regulation requires 100% of new vehicles to be zero emission in 2045.

Given the current truck population in the state of approximately 700,000 trucks, that would indicate measures should be taken to reduce the use of fossil fuels in these vehicles to further the state's air quality and greenhouse gas reduction goals.

Policy goals

The Case for Liquid and Gaseous Replacement Fuels

Passenger vehicles are getting better, lasting longer (edging up to 11.8 years in 2019, according to the U.S. Dept. of Transportation[6]). The economic headwinds encountered in 2020 promise to extend vehicle lives even further as consumers postpone new vehicle purchases in the face of an uncertain economy recovering from a worldwide pandemic.

With income inequities continuing to be an intractable problem, reliance on new vehicle introductions or even fleet turnover will not lead to the kinds of GHG reductions envisioned in some state scenarios (see Mobile Source Strategy, p. 65-66[7]). The premise of the proposed actions in the state's official Mobile Source Strategy is that more stringent regulations on combustion vehicles and increased incentives for zero-emission vehicles will lead to only ZEVs being offered for sale in California by 2050.

The gap between the existing fleet and these future projections can be bridged with cleaner, innovative, low-carbon fuels. Low-carbon liquid and gaseous fuels can have direct community benefits in that they typically can be deployed on a large scale, with benefits to disadvantaged communities that can be both direct and substantial. The economic and access barriers for members of disadvantaged communities to participate in low-carbon fuels programs are much lower than those found in electrification programs, since, in most instances, the use of low-carbon liquid fuels does not require a new vehicle purchase.

One promising pathway that is just beginning, but may enter the market quickly and have large near- and medium-term impacts, is carbon-neutral gasoline. Innovative fuel solutions propose to pull CO_2 from the atmosphere and, using surplus renewable

[6] https://www.bts.gov/content/average-age-automobiles-and-trucks-operation-united-states
[7] https://ww3.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf

electricity, create a low-carbon or carbon-neutral gasoline that would be a drop-in replacement for fossil-based gasoline.

In a similar vein, drop-in diesel replacement fuels such as renewable diesel are on the market and other diesel-replacement fuels with negative carbon intensity such as renewable DME are in development and could be on the market soon. Development of the latter has been funded by the California Energy Commission.

These fuels promise to not only reduce CO_2, but also attack high-GHG-value pollutants like methane and black carbon that impact not only climate change, but local and regional air quality. Furthermore, they hold the promise of immediate improvements to local air quality in regions of the state identified as disadvantaged communities since those locations are most likely to be sites of vehicles running on conventional fossil fuel.

In addition to fuels for cars and trucks, innovative fuels also can be used in the market to reduce carbon in hard-to-electrify sectors such as aviation, marine and emergency power generation. Encouraging the use of low-carbon fuels in these sectors can provide additional volume opportunities for these fuels as well as creating carbon reductions in additional transportation segments.

Jobs / Economic Impacts

The potential impact of innovative, California-produced, low-carbon fuels is significant. As an example, the CEC-funded expansion of Oberon Fuel's renewable DME production facility will provide at least 8-9 additional full-time, head-of-household jobs in a community (Brawley, in the Imperial Valley) where unemployment has been at record highs.

The production of innovative fuels in California also provides the potential of ancillary jobs by creating regional economies which include utilization of local feedstocks (such as California's extensive biomass), transportation of feedstocks and fuels, construction of new production facilities, and infrastructure development.

Cost Effectiveness / Leveraging Existing Resources

Production of innovative fuels in-state not only creates good jobs in the state, it also provides an economic benefit for the state economy by diminishing the reliance on domestic and imported fossil fuels. Use of local feedstocks could help create a circular economy in which local jobs gather feedstocks and provide them to local production facilities creating a fuel that is used by local residents.

California's drive to reduce GHGs and attack air quality issues has attracted private capital to the fuel sector. One example is the recent investment by BMW's iVentures in Prometheus Fuels, which is developing a technology to remove CO_2 from the air and turn it into zero-net carbon gasoline at prices competitive with petroleum gasoline. In

announcing the investment, BMW noted that even if there were a 100% shift to electric powered vehicles, because of the longevity of vehicles, fossil-fueled cars will be on the road for a decade or more and should also be targeted for emissions reductions. California policies such as the IEPR and programs such as the Low Carbon Fuel Standard make such innovations possible and enable these kind of investments.

Feedstocks

Feedstocks are a critical element to alternative fuels, impacting the carbon intensity and ability of a fuel to scale up to high-volume production.

Renewable hydrocarbon diesel is also commonly known as ”HVO” (”Hydrotreated Vegetable Oil” or ”Hydrogenated Vegetable Oil”). This term originates from the last decade when only vegetable oils were used as feedstocks. Today more and more of renewable diesel is produced from waste and residue fat fractions coming from food, fish and slaughterhouse industries, as well as from non-food grade vegetable oil fractions. Thus HVO and Hydrotreated Vegetable Oil are no longer complete terms describing the origin of the fuel.

Hydrotreating of fats, oils, and greases ("FOGs") to produce renewable diesel is a relatively new but already mature commercial scale manufacturing process. It is based on oil refining know-how and is used for the production of low-carbon biofuels for diesel engines.

The largest portion of feedstocks used in dedicated biomass refineries for renewable diesel to California is waste oils, such as animal fat and Used Cooking Oil with carbon intensity scores often 70+% less than the fossil alternative. With the expansion of co-processing of bio- and fossil feedstocks at a traditional fuel refinery, additional volumes of co-processed renewable diesel made from crop-based feedstock, like soybean oil, are increasing.

The demand for renewable diesel feedstocks increases as does the production capacity. Accordingly, producers are actively developing new technologies and new supply chains to widen and diversify the current waste oil feedstock portfolio and to ensure sufficient volumes of raw materials enabling the ability to maximize positive GHG impacts. This includes increased geographic expansion, use of lower-quality waste oil streams, and development of additional technologies to pre-treat or purify low-quality feedstocks to remove impurities.

For the mid- to long-term, renewable diesel producers like Neste are exploring technologies to introduce new raw materials into the portfolio along with corresponding new conversion technologies focusing on scalable, sustainable feedstocks and technologies enabling their use. These include waste plastics, lignocellulosics, municipal solid waste, micro algae and carbon dioxide capture and utilization.

These feedstocks and technologies are still being developed and do not yet have a conclusive carbon intensity score. However, indications are that the carbon reductions will be at least as great as the current slate of FOG feedstocks and technologies.

While some comments have been made about the limitations of feedstocks for renewable biofuels, renewable diesel and jet fuel producers such as Neste believe there are no real limitations given current and near-term technology. Neste has acquired a company that is an experienced collector and recycler of used cooking oils to bolster its connections to low-carbon feedstocks and enhance the creation of a circular economy supporting renewable fuels. Neste also acquired a terminal in Europe that stores, refines and blends renewable waste and residue-based raw materials, allowing the company to further develop its raw material logistics. Neste and other advanced biofuels companies continue to pursue alternatives to the use of feedstocks that might have other purposes, and the use of purpose-grown crops in order to reduce lifecycle greenhouse gases.

Research

The state's Low Carbon Fuel Standard (LCFS) has been a great driver of the innovation and use of low-carbon fuels. The CEC has the opportunity to spur further development of the fuels that power the vast majority of the vehicles on the road. In its own 2019-20 Investment Plan, the CEC estimated that more than 89% of the approximate 30 million vehicles in the state rely exclusively on either fossil gasoline or fossil diesel fuel. As a starting point, CEC should inventory the current status of transportation fuels in California in order to set a baseline for changes from increased innovative fuel use.

CEC funded research by Oberon Fuels on renewable DME aims to double production and show commercially viable pathways to commercial production for renewable DME as a diesel replacement fuel and for use as a blending agent to reduce the carbon intensity of propane (LPG). Innovative fuels like Prometheus Fuels renewable gasoline from CO_2 carbon capture and use of intermittent non-committed renewable fuels. Both of these types of innovative fuels, along with existing commercialized fuels like renewable diesel, offer the potential of near-term decarbonization of transportation fuels without disruption of existing infrastructure.

Expanding to Include Broader Transportation Fuel Use

The CEC should also expand the scope of this IEPR to include aviation fuels. Sustainable aviation fuels (SAF) are on the market and have the potential to significantly impact GHG emissions from planes operating within the state. The IEPR should address this segment and its potential impact on state GHG and criteria pollutant emissions.

Recommendations for Innovative Fuels Policy Updates

- Baseline Fuel Inventory – Create a current baseline inventory of transportation fuels – both fossil-based and renewable – to provide a view of the landscape that liquid fuel innovations can potentially impact. Include average or a range of carbon intensity estimates for various fuels.
    - Petroleum Gasoline & Diesel
    - First-Generation FAME Biodiesel
    - First-Generation Ethanol

- Renewable Diesel Fuel (RD)[8] –
    1) Assess and summarize the fuel's current technology and any potential GHG and emissions improvements (i.e. feedstock variances);
    2) Inventory existing stocks of RD fuel available for use in California;
    3) Estimate volume demand of RD usage in California through 2023.

- Renewable Dimethyl Ether (rDME) –
    1) Assess and summarize the fuel's current technology and any potential GHG and emissions improvements (i.e. feedstock variances);

[8] Neste's estimates of RD production capacity and usage in California.

Year	Capacity Added	Total RD Production Capacity* (million tons/year)
2021	**0**	**4.8**
2022	**1.19**	**5.99**
2023	**1.3**	**7.29**
2024	**2.9**	**10.19**
2025	**1.2**	**11.39**

Estimate of demand for RD usage in California.
2021: 1.78 million tons/yr
2022: 3.15 million tons/yr
2023: 3.27 million tons/yr

2) Review the CEC-funded demo project producing DME by Oberon Fuels to determine volume projections under low, medium and high production scenarios. For example:

   Oberon Fuels envisions a production capacity of 1.6 mil. gal of rDME/yr at its current facility in Imperial County with future expansion in palletized, localized production units.

3) Examine potential production rH2 from rDME using dairy methane and other in-state resources as a feedstock.

- Renewable Hydrogen (rH2) –
  1) Assess and summarize the fuel's current technology and potential GHG and emissions improvements based on different feedstocks and technology paths.
  2) Estimate volume demand for rH2 in the state for transportation.
  3) Estimate volume potential and retail cost for rH2 produced through various technologies and/or from various feedstocks.

- Renewable Gasoline (RG) –
    1) Assess and summarize the fuel's current technology and any potential GHG and emissions improvements compared to petroleum-based gasoline. For example:

       Zero net carbon fuel from direct air capture (DAC) and renewable electricity ("Prometheus Fuel" or alternatively in generic form "DAC e-fuel") has a Technology Readiness Level (TRL) of 7 to 8 and will be TRL 9 (meaning full commercial launch) in 2021. The fuel is designed to have a carbon intensity of 0 (g CO2/MJ), in that zero CO2 is added to the atmosphere by its use. Compare this to a carbon intensity of 100 for fossil-derived gasoline. Replacing all fossil fuels with DAC e-fuels can reduce California's CO2 emissions by 40%.

    2) Estimate potential volume demand of RG vs. petroleum gasoline under low, medium and high production scenarios. For example:

       DAC e-fuels are price competitive with fossil fuels. As gasoline and diesel fuels are commodities with high price sensitivity, the demand is the entire transportation fuel market.

    3) Quantify existing infrastructure for potential quantities of fuel that could be used with existing distribution and retail infrastructure. For example:

       DAC e-fuels are molecularly identical to fossil gasoline (although cleaner), and can use the existing distribution and retail infrastructure in its entirety with no modification.

       Prometheus will launch with 1 million gallons per year capacity in 2021 for demonstration. Its goal is to replace 25% of all gasoline in the US by 2025. Growth following this will be exponential and global, with the goal of replacing all fossil fuels with DAC e-fuels fast enough to stay below 1.5 °C increase in global average temperature.

- Renewable Propane (rLPG) –
    - Assess and summarize the fuel's current technology and any potential GHG and emissions improvements (i.e. feedstock variances);
    - Estimate potential volume demand of rLPG vs. petroleum gasoline under low, medium and high production scenarios.
    - Quantify existing infrastructure for potential quantities of fuel that could be used with a shift to rLPG.

- Sustainable Aviation Fuel –

- Assess and summarize the fuel's current technology and potential GHG and emissions improvements potential, incorporating information from the Atlantic Council's Report: Sustainable Aviation Fuel Policy in the United States: A Pragmatic Way Forward.[9]

- Prepare ongoing 5-year plans to move toward the state's goals
    - Create an ongoing plan looking in five year increments from 2020 to 2045, analyzing the status of purchase incentives and infrastructure for alternative fuel vehicles, the use of existing infrastructure and perceived needs for expansion.
    - Quantify the impact of the above fuels on the state's GHG reduction and petroleum use reduction plans.

[9] https://www.atlanticcouncil.org/event/sustainable-aviation-fuel-policy-in-the-united-states-a-conversation-with-fred-ghatala/