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Comments on the ARFVTP (AB 118) 2018-19 Investment Plan Update

See attached

Additional submitted attachment is included below.

Comments on the ARFVTP (AB 118) 2018-19 Investment Plan Update (Second Revised Staff Report) and Recommended Changes¹

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The Second Revised Staff Report on the AB 118 2018-19 Investment Plan Update is much more than an update, it is a radically revised plan that abandons previous balanced approaches to competing alternative fuels and vehicle technology approaches to reducing greenhouse gas emissions from California's transportation sector. In particular, funds to support a much more rapid expansion of EV charging infrastructure, and H2 refueling infrastructure to underwrite an increase HFCV sales in California has been emphasized. Justification for this change is given to a recent executive order issued by Governor Brown to state agencies to support an expanded target of 5M plug-in EVs in California by 2030. Currently, there are less than 400K such vehicles in California and the growth in this market has been too slow to achieve the vehicle numbers desired in the executive order. So the executive order and supporting regulatory actions by the CEC select two technology pathways (EVs and HFCEVs) for specific, aggressive technology forcing efforts by the state.

These vehicle technologies have the benefit of having no (zero) criteria pollutant emissions from the tailpipe, with emissions displaced to the point of power or H2 generation and/or storage or associated with such activities. The use of these types of vehicles and fuels could help to solve difficult air quality problems, especially in the South Coast region and the San Joaquin Valley, if significant numbers of vehicles can be sold to the public. Additional funds have been allocated to the ARFVTP program in the governor's proposed budget to support EV and HFCEV programs, but some funds apparently have been diverted from other pathways in the ARFVTP program as well, most particularly from biomass-based pathways. This is vaguely justified by mentioning other state and federal programs that support biomass energy in California. This has always been the case but previously not seen as a justification for reducing biomass related funding. Other state and federal programs support the preferred technologies in the ARFVTP as well², but only alternative funding sources and statutory support were considered for biomass programs in deciding to reduce allocation levels (Table 5, page 23).

I have been an ARFVTP advisory committee member from the beginning of the program. My academic work focuses on the sustainable use of biomass for energy, but I otherwise have no specific affiliation with any company or technology. I try to think about policies in as unbiased a fashion as I am able about the public interest in the alternative fuels and vehicle technology area, and how policies affect the large

¹ http://docketpublic.energy.ca.gov/PublicDocuments/17-ALT-01/TN222847_20180305T120205_201819_Investment_Plan_Update_for_the_Alternative_and_Renewable.pdf

² <https://www.afdc.energy.gov/fuels/laws/HY/CA>

public goods at stake, including correlated public goods that are affected by transportation energy policy. I offer these comments on the revised investment plan from this perspective.

The current draft revised staff report is a significant policy statement and change in program philosophy. While responding to recent executive actions, it departs from previous principles that have guided the program and from the statutory language that was the basis for California's GHG reduction approach and the AB 118 itself, which emphasized technology neutrality in the allocation of state resources, and required avoiding favoring specific technologies. Up to this point, the ARFVTP program has been managed consistent with those guidelines. With the loss of this balance, increased overt competition among advocates for different alternative technologies has been introduced into advisory committee deliberations.

An emphasis on EVs and HFCEVs should not come at the expense of funding needed to support biomass based fuels and technologies. The revised plan lists the types of projects previously funded by the ARFVTP program (pages 10-11)³. These can be considered an effective and tested set of guidelines for funding allocations in the program. All but one (#9) either explicitly mention biomass fuels or can be and have been applied to supporting vehicle and infrastructure technologies associated with biomass fuels.

I have worked on the assessment of biomass supply, analysis of pathways for its use, and the sustainable production and use of biomass for energy in California for many years. This includes work with many levels of government, especially the California Energy Commission, on the development of biomass action plan, technical reports, public meetings, and other types of guidance for the use of biomass in the state's energy economy⁴. Such uses, prudently chosen, have many important related benefits for the sustainable management of forested and agricultural landscapes, as well as for efficient use of urban residual biomass resources. They help the state most efficiently meet its important **short-lived climate pollutant (SLCP)** objectives⁵. Biomass non-use, resulting from many status quo or default policies has real, adverse effects on the state's natural resources, notably but not exclusively on black carbon emissions from increasingly damaging wildfires (with associated loss of property) and direct, harmful effects on public health. These include: (i) the use of urban residual biomass for biogas production and its use in low emission trucks and buses, (ii) similar programs for methane capture and use from the state's dairy sector, (iii) increased storage of carbon in urban and agricultural soils, (iv) reduction of emissions from open burning of agricultural woody biomass, and most dramatically, (v) ever increasing economic losses, public health effects, and ecological damage from wildfires throughout the state. Biomass derived fuels are the only pathways that can be used to reduce the cost and provide many

³ "The ARFVTP program includes projects that: 1. Reduce criteria and toxic air pollutant emissions from vehicles. 2. Reduce the use of and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies. 3. **Produce sustainable, alternative and renewable low-carbon fuels in California.** 4. Expand alternative fueling infrastructure and fueling stations available to the public, existing fleets, public transit, and transportation corridors. 5. Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies. 6. Retrofit medium- and heavy-duty on-road fleet and non-road freight vehicles to alternative technologies or fuel use. 7. Offer incentives for the purchase of alternative fuel vehicles. 8. Establish work force training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies. 9. *Support local and regional planning for zero-emission vehicle and fueling infrastructure deployment.*"

⁴ These activities are partially documented at: <https://biomass.ucdavis.edu/>

⁵ <https://www.arb.ca.gov/cc/shortlived/shortlived.htm>

correlated public goods from the state's important SLCP program. The goals of the SLCP have not changed nor become less important, despite the state's new emphasis on zero emission vehicles. Many important public goods and goals can only be addressed through biomass-based programs.

In such cases, near-zero engine technologies (including technologies like low NOx engines using bio-CNG and higher-octane fuel and adapted engine technology), likely are the optimal pathways consistent with state policy. They best support the state's primary climate objective of reducing greenhouse gas emissions from the transportation sector, while also lowering criteria and other tailpipe emissions. The lowest carbon intensity fuels and pathways available are biomass-based and the future promises more such pathways if the AB118 program remains intact⁶. These fuel values are in some cases much lower than average estimates for EV vehicles, even with California's relatively high level of renewable energy sources contributing to its power mix. The state has sought to encourage this pathway to biofuels and biopower through legislation and in some air quality districts, only transportation fuel use will be possible⁷. It should be remembered as well that the current and foreseeable source for hydrogen for HFCEVs is natural gas, a fossil fuel (discussed below).

The positive case for alternative fuels has been made frequently. Benefits include the use of underutilized residual biomass resources, like the organic fraction of MSW and materials from the state's food processing industries and food distributions systems. Residual agricultural biomass like wood from old trees and vines, and methane captured from dairy manures all require fuel end uses to be profitable. Dead tree removal and wildfire prevention in forested and chapparel landscapes through fuel load reduction programs have multiple ecological and public health benefits. There are also opportunities for a discrete number of crop and by-product-based biorefineries in the state. All of these pathways especially benefit rural areas with underserved and disadvantage populations if successful biorefineries and related industries can develop. Such jobs and related economic multiplier effects provide the strongest, if not the only direct benefits to people living in rural areas where unemployment and social disadvantage is great⁸. Rural, disadvantaged populations otherwise typically experience the state's climate policies only as significant increases in the cost of living.

If we are to develop in-state biomass derived fuels and power, new GFOs focused on feedstock development and conversion, as well as supportive infrastructure, are still needed. ARFVTP has allowed for more diverse and innovative approaches to alternative fuel development than other state programs, which commonly have narrower criteria and are more narrowly directed, administratively. This innovative quality is unique in the transportation policy area to the AB 118 program so far as I know, and is its most useful characteristic. It has been the best approach among state programs to attract and

⁶ <https://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm>

⁷ SB 1383 calls for increased renewable natural gas in the natural gas grid. Also, diversion of organics from landfill, the subject of AB 1826 and 1594, requires the anaerobic digestion or composting of municipal organic waste. Anaerobic digestion is the most effective technology for maximizing the reduction of SLCPs. Converting organics to electricity is not an option in the South Coast Air Quality Management District because air quality offsets are required for electric power generation in Southern California. The cost of providing these offsets makes electric power production from organics infeasible in Southern California, and likely in the San Joaquin Valley as well.

⁸ See for example: https://biomass.ucdavis.edu/wp-content/uploads/TASK-4-Integrated-Assessment_Final.pdf ; and https://biomass.ucdavis.edu/wp-content/uploads/Forestry-Biomass-Fuel-Potential-6_24_2015-web-version.pdf

support innovative alternative fuel proposals with large correlated social, economic and ecological benefits. This need and these goals have not changed, even with a new emphasis on supporting zero emission vehicles. A political commitment only to zero emission pathways ignores these obvious benefits.

In all previous years, AB118 investment allocations were carefully balanced to support the diverse, contending technology interests. Allocations did not reflect program impact, or biomass fuels would have received the largest share of resources. Even NREL's estimated future benefits (Page 26, Table 7 and Page 27, Table 8) indicate disproportionate GHG reduction benefits for alternative fuels compared to other technologies. But balancing allocations has served the program and the state well over the last decade. This year, however, winners and technologies have been chosen despite fundamental statutory guidelines, and there has been a merely nominal commitment to benefit/cost estimation as a basis for resource allocation⁹.

Similarly, the assertion that the "state" has chosen to focus nearly exclusively on zero emission vehicles begs the question of what is meant by the "state" and who is included in that expansive term. With nearly 40M residents with highly diverse interests, needs, and priorities, it is presumptuous to make decisions of such economic magnitude primarily on the basis of Commission staff recommendations. Clearly, staff responded to direction in drastically changing both relative allocations of resources and program philosophy. Vague language¹⁰ obscures the reasons for the elimination of funding for biomass related projects from the core AB 118 program itself. The use of Greenhouse Gas Reduction Funds (GGRF) is proposed instead but these may or may not be forthcoming, subject to the legislature's

⁹ Pages 18-19: "AB 8 introduced the GHG benefit-cost score as a new element into the list of policy and scoring preferences for ARFVTP. It is defined as "...a project's expected or potential greenhouse gas emissions reduction per dollar awarded by the Commission to the project." AB 8 also directs the Energy Commission to "give additional preference to funding those projects with higher benefit-cost scores." Energy Commission staff applies the benefit-cost preference when evaluating proposals for similar types of projects during funding solicitations. Benefit-cost measurements and scoring are incorporated into the development of solicitations and the review of proposals for the ARFVTP. The "benefit" is calculated as the amount of conventional fuel displaced per year by the resulting alternative fuel or technology, multiplied by the carbon intensity of that fuel or technology relative to conventional fuel. This calculation results in an estimate of direct GHG reduction benefits from a proposed project. The "cost" is based on the requested ARFVTP funding amount. Dividing the "benefit" by the "cost" produces a benefit-cost ratio that staff uses in ranking similar proposals within a competitive solicitation." The report goes on to state that this criteria is devalued for technologies that staff regard as promising but pre-commercial. But cost/benefit evaluations are an appropriate and wholly reasonable criteria for the comparative analysis of vehicle technologies and alternative fuels when it comes to spending public funds. In such cases, the preferences of CEC staff may not be a sufficient basis for significant investment of public funds. The commissioners should solicit external public input as widely as possible to help avoid picking specific technologies.

¹⁰ "The proposed budget also includes a \$25 million allocation from the GGRF for the Energy Commission to fund Low-Carbon Fuel Production projects. Though this GGRF allocation is not part of the ARFVTP, alternative fuel production and supply projects supported by the Energy Commission have historically been funded by the ARFVTP. As such, this \$25 million allocation from the GGRF is included in this *2018-2019 Investment Plan Update*. In the event that a different amount of funding is available, the allocations in this document may be revised in subsequent versions or amended after final adoption." Page 5, Executive Summary. There is no logic to this statement. It is first noted that funds for low-carbon fuels have always been included in AB 118 investment plans, but then simply states that "as such" they will not be included this year, but instead be swapped for uncertain allocations in the governor's proposed budget. Minus the uncertain funds from the governor's budget, low carbon fuel funds will apparently otherwise be eliminated from the investment plan. The revised plan avoids saying this directly.

decisions. Phrases used on page 5 like “appropriately balance funding,” and “maximize benefits” are undefined there and vague and inappropriate in a planning document that directs so much public investment. What criteria are actually used to maximize benefits? Which benefits are considered most important, reduction in criteria emissions or GHG emissions? Are tradeoffs possible? Is the maximization of benefits a judgement for staff? Such important considerations require the broadest possible public input and sufficient time and effort to effectively census. Without an adequate consensus focused process, the integrity of the ARFVTP program is at stake.

Concerns about hydrogen pathways

Regardless of relative allocations of resources within the ARFVTP program, I have concerns about the hydrogen pathway. In making these comments, I have no intent to disparage H2/HFCEV pathways, but simply to caution prudence and greater balance in making ARFVTP allocations, especially given the very low and uncertain benefit/cost ratio for such a large allocation of scarce resources.

H2 is a versatile and valuable energy carrier. It has countless current uses in the energy economy, many identified in an advocacy document mentioned during the recent ARFVTP advisory committee meeting¹¹. The uses promoted by the current allocation to H2/HFCEVs is largely for fueling infrastructure, with the sources of H2 ignored. Currently, H2 for vehicles is almost entirely derived from natural gas, a fossil fuel. This is seen as a bridge toward future H2 supplies that may be derived periodically from excess solar and wind power, currently either curtailed, grounded, or sold at a loss. Power might be diverted to electrolysis devices and the resulting H2 stored until needed, or sold directly. Using surplus capacity would improve the costly economics of wind and solar systems. But electrolysis is very energy intensive and costly, and will not develop without significant public subsidy. Storage and distribution will be expensive and is not well defined. It is hard to foresee how a large demand for H2 can be met in this way in any reasonable time frame, without increasing new demand for and on-going reliance on fossil natural gas. A requirement exists in statute (SB1505) that at least 33% of the H2 used for fuels be renewable once more than 20K vehicles are in use in the state. This requirement helps reduce the carbon intensity (CI) of H2 fuel in theory. But to date It is unclear if any renewable H2 is being produced in the state and physically blended with fuel H2. Nor does mandating such levels of use solve the problems of source, expense and alternative uses.

H2 can be made from biomass via a thermochemical process called gasification, in which heat, H2 and CO are produced¹². H2 is a fraction of the gasifiers output. Woody biomass is especially well suited for thermochemical conversion. Biomass gasification can have many benefits (see ftnt 8) but to date has failed almost all tests of commercialization and scale. Ironically, the most promising current gasification pathway that relies on woody biomass from removed orchards in the Central Valley, results not in H2 and CO, but in ethanol as an end-product¹³. This process is entering commercial scale development. It is possible only because a traditional conventional ethanol biorefinery supports the addition of a new, complementary technology. The fuel will likely be an ultralow CI fuel. Nissan has developed a HFCEV that uses ethanol, not H2, as the energy carrier, making this a sustainable pathway to fuel-cell

¹¹ Hydrogen, Scaling Up. 2018. The Hydrogen Council. This report largely avoids discussing the H2 source problem except in general terms. <http://hydrogencouncil.com/hydrogen-scaling-up/>

¹² https://biomass.ucdavis.edu/wp-content/uploads/Task7-Report_Biomass-Gasification_DRAFT.pdf

¹³ <http://www.biofuelsdigest.com/bdigest/2018/03/08/commercial-time-aemetis-embarks-on-158-million-cellulosic-ethanol-project-in-california/>

technology in vehicles¹⁴. It would require access to 100% ethanol refueling infrastructure, not currently part of the revised ARFVTP Investment Plan. This example demonstrates why highly siloed thinking about program allocations in the ARFVTP is technologically limiting and counter-productive. Also, how biomass complements many technologies.

A technology with much lower costs and broader benefits is the use of ethanol in high-octane fuels with next generation high compression engines. The greenhouse gas reduction benefits of low CI ethanol like that to be produced by companies like Aemetis would be further enhanced if by use in higher-octane fuels and adapted engines, a pathway currently ignored in California. In my view, the lack of analysis of a viable alternative technology is contrary to statute¹⁵, which forbids favoring selected technologies. California should objectively evaluate this pathway as statute requires. Prudent choices by policy makers cannot be made if all reasonable alternatives have not been objectively compared or worse, deliberately ignored.

There is no guarantee that alternative H2 will be used for transportation fuel since there are multiple competing uses for any H2 generated, especially from low CI sources. These include the chemical industry, the bio-products industry, emerging mandates for low CI jet fuel, and for conventional petroleum refining, among others. Often, alternative uses are more profitable than fuels. There are many examples but an important one for a California based company is Amyris¹⁶, which started out intending in part to make fuels from biomass via its innovative and proprietary processes, but quickly focused on more valuable bio-based chemical feedstocks instead. It would be unwise to assume that H2 made from surplus renewable power or biomass will first find its way into the transportation sector when alternative uses may be simpler technically and more profitable.

An anticipated 37,400 HFCEVs are hoped for by 2023. There is a \$92M allocation for H2 refueling in 2018-19 with presumable more to follow in subsequent years. This is approximately 4x the allocation for biomass, if GGRF actually become available. This is a huge cost for what may be a very limited benefit (see Tables 7 and 8 in the revised plan). Is this a highly risky wager of public funds? Changes in vehicle and fuel policies occurring at the federal level may interfere with the goals set here for the state. What if public demand for HFCEV vehicles fails to materialize? The same question can be asked about EVs. In any case, there will still be a very large number of gasoline, diesel and jet fuel powered vehicles and planes in use in California in 2030 and the state will benefit from the lowest CI liquid fuels.

Special attention is needed in the ARFVTP Investment Plan for the San Joaquin Valley

The San Joaquin Valley has the worst air quality characteristics of any region of the state. It is home to a large number of lower income Californians and has concentrations of people from disadvantaged communities. More than currently, it should be a specific focus of resource allocations in the ARFVTP program. Intuitively, the penetration of EVs and HFCEVs will be more difficult and slower among these populations and in these areas. Indeed, to date, it has been noted that most of the benefits of alternative vehicle subsidies and even rooftop solar PV programs have gone to the more affluent

¹⁴ <http://www.biofuelsdigest.com/bdigest/2016/06/15/nissans-solid-oxide-fuel-cell-system-and-what-the-fuss-is-all-about/>

¹⁵ AB 32 (Nunez, Chapter 750, Statutes of 2007, California Health and Safety Code 44272(a): The Energy Commission shall ..."develop and deploy technology and alternative and renewable fuels in the marketplace, **without adopting any one preferred fuel or technology.**" (Emphasis added).

¹⁶ <https://amyris.com/our-story/>

populations in the state. Vehicle technologies and alternative fuels with lower emissions than current technologies may be lower cost and more certain means to help reduce air quality measures in the state. For example, increased markets for bio-CNG in MDV using low NOx emission engines would increase the demand for dairy and MSW derived biogas in the region, and help reduce criteria emissions from the many trucks operating in the SJV, especially in the very short term. Higher octane fuels and related engine technologies reduce emissions and are potentially more affordable solutions for disadvantaged populations. Any program that supports fuel load reduction and healthy forests in the state's Sierra Nevada region or reduces open burning of woody agricultural residues helps reduce smoke from forest fires and ag burning. Forest fires have been occurring with increasing frequency and intensity and are forecast to intensify in many climate scenarios. Reducing black carbon emissions is an important goal of the state's SLCP program and would especially help people living in the SJV region where smoke from wildfires and ag burning is a yearly and increasing problem. The AB 118 alternative fuels GFO programs facilitate technology development and the economic use of these biomass resources, helping reduce the cost of maintaining the state's forested ecosystems and directly improving air quality.

At a minimum I suggest that the CEC make a formal commitment to the tentative suggestion made in the revised investment plan on page to consider bio-CNG fuels, vehicles and production systems, especially in the SJV region¹⁷.

In general, the California Energy Commission should resist the temptation to consider its investments in a siloed manner and look for integrative solutions to transportation system improvements, especially those that also help promote or achieve other important public goods. This is especially challenging in areas like the SJV where many solutions could involve biomass and alternative fuels. Such technologies also have the largest potential to contribute to employment and wealth generation in this region with large biomass resources.

For these reasons, the next revision of the investment plan should restore funds for alternative fuels and related infrastructure and consider the governor's proposed supplement to this category as additional support, as I believe was intended. Restoring AB118 funding for alternative fuels and related infrastructure to the amount recommended in the previous investment plan is a small change compared to the investment amounts proposed in the most recent version of the investment plan and should be feasible without drastically affecting funding for other technologies.

¹⁷ Page 69: "To encourage the use of very-low-carbon biomethane as a transportation fuel, the Energy Commission may consider future funding solicitations that use funding from multiple investment plan categories to deploy vertically integrated biomethane production and distribution facilities, as well as low-NOx natural gas vehicle fleets to use the renewable fuel. Combining all three aspects of fuel production, distribution, and use into one project may ease the barriers associated with biomethane use by providing a dedicated renewable fuel source and a dedicated market for the fuel. Such a solicitation may combine funding from any or all of the Biofuel Production and Supply, Natural Gas Fueling Infrastructure, Natural Gas Vehicles, or Advanced Freight and Fleet Technologies funding categories, as appropriate." This is a very good idea but it runs into significant financial limitations if current proposed funding levels are maintained.