Jerilyn Lopez Mendoza
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SoCalGas
A Sempra Energy utility

Jerilyn López Mendoza
Program Manager
Environmental Affairs

555 W. Fifth Street, GCT 17E5
Los Angeles, CA 90013

tel: 213.244.5235
fax: 213.244.8257
email: jmendoza5@semprautilities.com

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Yachun Chow
Manager, Zero Emission Truck & Bus Section
Mobile Source Control Division
Sacramento, CA 95812
Via Email – yachun.chow@arb.ca.gov

Re: Comments on California Air Resources Board "Advanced Clean Transit Regulation Discussion Document" Released May 2015

Dear Ms. Chow:

The Southern California Gas Company ("SoCalGas") is pleased to submit these comments to the California Air Resources Board ("ARB") regarding the Advanced Clean Transit ("ACT") Regulation Discussion Document ("Discussion Document"). We recognize this is only the beginning of what will be a more formal, stakeholder-involved process. We wanted to take this opportunity to express some of our initial concerns and suggestions regarding the ACT Discussion Document and the ARB's proposed regulatory concepts.

The Analysis in the ARB Discussion Document Is Incomplete

Based upon our initial review of the Discussion Document, we believe ARB needs to provide additional, more comprehensive data to justify the proposed ACT regulation. In the Discussion Document, ARB provides no cost-effectiveness estimates identifying the air quality or greenhouse gas ("GHG") benefits of the proposed State's investment in this ACT approach. SoCalGas thinks much more information needs to be provided by ARB to justify what we believe will be a massive economic expense to the State, transit agencies and the public at large without a commensurate environmental outcome.

A. Acquisition Costs of New Zero Tailpipe Emission Buses Will Be Onerous

According to the most recent data available, thousands of transit buses would need to transition to zero tailpipe emission buses to comply with ARB's proposed regulatory concepts. Billions of dollars will be needed to purchase new buses, provide the necessary battery charging and hydrogen fueling infrastructure, and utility upgrades for 11,169 existing urban buses and transit fleet vehicles currently operating in California transit fleets.[1]

Our preliminary analysis[2] indicates that California transit agencies could be responsible for several billion dollars in new bus capital costs above business-as-usual natural gas or diesel operations to implement ARB's ACT plan over the course of the regulation (2018-4040). The projected increased costs do not account for any future infrastructure development costs or maintenance costs to the transit agencies, which SoCalGas anticipates will be significant. Transit agencies will also have to maintain higher ongoing annual expenditures following 2040 to continue purchasing compliant zero emission tailpipe buses, which could equal hundreds of millions in ongoing annual bus capital incremental costs.

ARB Projections of FTA Funding May Be Overly Optimistic

ARB assumes that Federal Transit Administration (FTA) funding will cover 82% of the expense for zero tailpipe emission bus costs, because FTA funding generally covers up to 80% of conventional fueled buses and up to 82% of CNG-fueled buses.[3] If these assumptions about FTA funding were correct, preliminary analysis indicates that California transit agencies would expend over a billion dollars in incremental costs to acquire compliant buses over the life of the regulation.[4]

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[1] See Discussion Document p. 5, Figure II-1.

[2] SoCalGas worked with our technical consultants, Gladstein, Neandross & Associates (GNA), to better determine the true cost of the proposed ACT plan for transit agencies and the state of California. Our preliminary analysis indicates that ARB's Federal Transit Agency ("FTA") assumptions underestimate the cost for CA transit agencies to comply with the ACT regulation by a factor of five, for bus capital alone. Although we recognize that there are many unanswered questions, such as the final phased-in purchase requirements for zero emission tailpipe buses, the breakdown between battery and fuel cell technology adoption, and long-term pricing for advanced technologies, the preliminary analysis indicates that the costs incurred by CA transit agencies will be several billion dollars more than what ARB's FTA assumptions would indicate, and demonstrate the sheer scale of the true investment to comply with the proposed rule. SoCalGas and GNA are continuing to work with FTA, transit agencies, and technology manufacturers to refine cost estimates and develop a similar infrastructure cost model.

[3] FTA 5307 funding for individual transit agencies is determined by a formula based on population, population density, number of low-income individuals, bus revenue vehicle miles, bus passenger miles, fixed guideway revenue vehicle miles, and fixed guideway route miles. This formula-determined allocation can then be used to fund capital, planning, job access and reverse commute projects, as well as operating expenses in certain circumstances. These funds constitute a core investment in the enhancement and revitalization of public transportation systems. Source: http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Urbanized_Area_Formula_Grants.pdf.

[4] SoCalGas' preliminary analysis assumed that the state would replace the current transit fleet of 9,908 buses with 50% battery electric and 50% fuel cell electric buses to meet the zero tailpipe emission bus requirements.

However, this funding assumption is flawed because it ignores the fact that a transit agency's total allocations under section 5307 are determined by a complex mix of formula-based factors, and that this funding is intended to cover a range of capital assistance and operating costs. California transit fleets will not be automatically entitled to higher FTA allocations overall simply because they have more expensive in-state regulations. Although transit agencies would be able to request up to 82% in section 5307 funding from FTA to cover zero emission tailpipe bus purchases, such an allocation would come at the direct expense of funding other vital capital and operating costs also directly supported by 5307 funds.[5] Accordingly, ARB projections of FTA funds for zero tailpipe emission bus purchases should be based on a more probable assessment of overall FTA funding impacts for transit agencies under any ACT purchase requirement scenario.

Assuming that the bus costs listed in ARB's Discussion Document are accurate, a fleet that could normally purchase 15 natural gas buses with its FTA allocation would only be able to purchase 10 battery electric buses with that same FTA allocation. Alternatively, the agency would have to offset an additional four million dollars in operational or capital investments elsewhere to buy the 15 needed replacement buses while complying with zero emission tailpipe bus purchase requirements. In essence, the zero emission tailpipe bus purchase requirement would offset other critical transit investments to maintain the same number of buses on the road.

A more probable funding scenario assumes that FTA will continue funding total bus capital for California at approximately the same level as current allocations, after accounting for population growth and other factors that impact the formula-derived allocations. Therefore, it is reasonable to assume that California transit agencies will continue to receive FTA funding that is sufficient to cover approximately 82% of a conventional diesel or natural gas bus. Under this more probable FTA funding scenario, preliminary analysis indicates that ARB's FTA assumptions could underestimate the cost for California transit agencies to comply with the ACT regulation by a factor of five, for new bus capital alone. Therefore, the costs incurred by California transit agencies over the compliance timeframe could be several billion dollars more than what ARB's FTA assumption would indicate, not including charging or fueling infrastructure or maintenance costs. Incorporating new electric charging and hydrogen fueling infrastructure costs could add billions more to the shortfall.

B. ARB Should Adopt Fuel-Neutral, Performance-Based Policies

There are alternative approaches that could also accomplish critical state goals at a fraction of the price to transit agencies and taxpayers, such as near-zero emission engines coupled with renewable fuels. SoCalGas understands that Cummins Westport is currently certifying a near-zero emission natural gas engine (0.02 gram per brake horsepower-hour (g/bhp-hr)), and other natural gas and diesel engine manufacturers are working on short-term commercialization of

[5] Transit agencies will submit requests for up to their maximum formula-determined allocation, with federal cost share provided with the following limits by category: 80% for capital assistance (this includes buses), up to 82% for alternative fueled vehicles; 50% for operating assistance; and 80% for Americans with Disabilities Act non-fixed route paratransit service. Source: http://www.fta.dot.gov/documents/MAP-21_Fact_Sheet_-_Urbanized_Area_Formula_Grants.pdf.

similar near-zero emission products. If these technologies were used in conjunction with renewable fuels, transit agencies could achieve similar reductions in NOx, well-to-wheels GHGs, and petroleum displacement as with a 100% zero emission bus strategy.

For example, if transit agencies transitioned their entire fleet to 0.02 g/bhp-hr near-zero CNG buses using 100% renewable biomethane fuel from landfills, they could achieve 90% reductions in tailpipe NOx, up to 78% reduction in well-to-wheels GHGs, and 100% displacement of conventional petroleum. Under a 100% zero emission bus plan6, transit agencies would achieve 100% reduction in tailpipe NOx, up to 55% reduction in GHGs, and a 100% displacement of conventional petroleum.[7]

If ARB set rigorous performance-based emission and petroleum reduction targets, each transit agency could choose the technology best suited to its individual operations, while still meeting goals that are in line with the state's ambitious emission and petroleum reduction targets.[8] This performance-based emission reduction approach could save transit agencies billions of dollars in anticipated compliance costs over the course of the regulation, versus the proposed ACT concepts identified in the Discussion Document.

C. ARB Should Provide More Robust Analysis on Infrastructure Charging and Fueling Costs

Battery Electric Charging Infrastructure: ARB charging infrastructure appears to be understated at $40,000 per fast charger and redundancy is not considered in calculation, such as number and location of chargers.[9] For example, Proterra's proprietary fast-charger costs $369,000[10], and can support depot charging for up to eight battery electric buses. As of September 2015, only two bus manufacturers, Proterra and New Flyer, offer a fast charge bus that has completed Altoona testing. Proterra's fast-charge bus technology offers only 30 miles per charge while its slow charge bus technology is capable of up to 100 miles per charge. With transit agencies providing services over a variety of route profiles, each transit agency will likely need a mix of slow and fast-charge options.

In SoCalGas discussions with local transit agencies, we have learned that en-route fast charging would certainly be necessary for many routes served by battery electric buses ("BEB"). Agencies are gaining some experience with electric buses and believe they currently have a range of ~150 miles and may extend that to ~200 in a year or two. However, agencies need

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[6] This scenario assumes 50% battery electric and 50% fuel cell bus deployments, with all fuel cell buses using 33% renewable hydrogen fuel.

[7] Well-to-wheels CO2e emissions are based on ARB's assumption that urban transit buses travel an average of 36,400 miles/year and calculated based on the number of zero tailpipe emissions and near-zero emissions buses deployed according to the purchase requirement. Well-to-wheels CO2e emissions are determined using estimated carbon intensity values for pathways under CA-GREET 2.0, as provided by ARB Staff in the document, "CA-GREET 1.8b versus 2.0 CI Comparison Table," April 1, 2015.

[8] The achievement of these goals is in line with the Performance Targets articulated by Governor Edmund G. Brown, Jr., and legislative requirements. Discussion Document, Executive Summary, p. i.

[9] Discussion Document, p. 21, which assumes the installed cost of a direct current fast-charging station at $40,000.

[10] "Electric Vehicles: Ex-Tesla Exec Moves on to Build Battery-Powered Buses," April 9, 2015, Greenwire, accessed from http://www.eenews.net/gw/2015/04/09.

buses capable of at least 275 miles range per day. Agencies do not believe that is possible given the weight issues (batteries are very heavy), logistics of charging, and other operational challenges. Further, there are limitations to the number of units that can use a charging station (eight units for Proterra's FC charger, for example). Each bus route may need its own en-route fast charge support, or may require operational (and labor-related) cost changes. Lifecycles of chargers should also be considered as part of ongoing operational costs, which is currently projected at six to eight years under heavy usage.

Calculated differently, BEB charging costs ($/kilowatt hour) appear low in the Discussion Document. ARB needs to complete additional analysis to cover peak demand en-route charging versus overnight fueling for more accurate cost impacts. Regarding BEBs, there are further significant questions about where this en-route infrastructure can be installed. Are there public facilities to support en-route charging? Who will own these chargers? Who will control the charging rates? How will peak-time en-route charging rates change cost calculations? What physical upgrades will be required to support increased grid demand for depot fueling at transit facilities? We respectfully request that these and other such questions about electric charging infrastructure be addressed by ARB as the ACT regulation proposal moves forward.

Hydrogen Fuel Infrastructure: ARB's Discussion Document makes no note of hydrogen fueling station costs, which are anticipated to be significant, particularly if fuel cell electric buses ("FCEB") are intended to support routes with operational challenges that cannot be met by BEBs, as is implied in the Discussion Document plan. Although we do not have information about what the infrastructure planning and costs might be for heavy-duty FCEB, we believe the recent California Energy Commission ("CEC") plan for light-duty fuel cell vehicles confirms that significant planning and investment is required for hydrogen fueling infrastructure. The CEC's 2015-2016 Investment Plan Update for the Alternative and Renewable Fuel and Vehicle Technology Program ("ARFVTP") notes hydrogen refueling stations are much less common than conventional gasoline stations or even other alternative fuel stations. As of March 2015, 11 hydrogen refueling stations in California were operational. By late 2015, the California network of operational hydrogen stations is projected to include up to 46 stations, with four additional stations scheduled to come on-line in the first quarter 2016, and a further four by second quarter 2016. These stations are designed to support consumer operations, and there is not currently an existing or planned network of heavy-duty transit-capable hydrogen fueling stations to support the ACT rollout.

ARB notes that the current price of hydrogen is approximately $6 to $9 per kilogram for a high capacity hydrogen station.[11] Prior analysis[12] of zero emission buses found that the anticipated

[11] Discussion Document, p. 13 (b). Although unstated, for purposes of this discussion, SoCalGas assumes the approximate price indicated in the Discussion Document is traditional hydrogen and not renewable hydrogen. Renewable hydrogen is expected to cost much more to produce.

[12] Gladstein, Neandross & Associates (GNA), "Equivalent Strategies for the ARB Zero Emission Bus (Z-Bus) Regulation," June 2014. The price of hydrogen varies greatly in various reports so GNA selected one of the lower reported prices, estimated to be $8.5 per kilogram for hydrogen produced via steam methane reformation. The price includes the cost of the natural gas, water, and the electricity used by the reformer and the compression equipment, and also includes the cost of amortized capital and maintenance. This price was sourced from "National Renewable Energy Laboratory. SunLine Transit Agency Advanced Technology Fuel Cell Bus Evaluation: Fourth Results Report. By L. Eudy and K. Chandler. NREL/TP-5600-57560. January 2013."

costs were at the higher end of this range ($8.5/kg). The price of traditional hydrogen per kilogram should be confirmed and updated with current fuel cost figures, and the projected cost of renewable hydrogen should be calculated with most current available data.

California Energy Commission funding, and therefore state infrastructure planning, is targeting light-duty consumer stations. The state infrastructure funding is based on previous average costs to the ARFVTP for the installation of new light-duty hydrogen refueling infrastructure (roughly $1.8 million–$2.1 million). The Energy Commission is also offering up to $100,000 in operation and maintenance funding per station, recognizing these needs are significant. Transit station development, operation, and maintenance costs can be expected to be much higher.

Thus, we believe there is a huge infrastructure and fuel cost from ARB's ACT approach, above and beyond the capital costs of purchasing new buses. We believe these total lifecycle impacts will be significant, for both BEB and FCEB implementation approaches, and that FTA and other grant funding may be inadequate to support the expense. As stated above, the total bus capital incremental cost increase for a zero tailpipe emission bus approach is in the multi-billion dollar range. Additionally, total charging and fueling infrastructure incremental cost for a zero tailipipe emission approach must also be factored into the overall cost of the proposed ACT transition. We respectfully request that ARB provide an infrastructure charging and fueling cost estimate for zero tailpipe emission vehicles in its next update on the ACT regulation.

Natural Gas Infrastructure: Fifty-seven percent of California's 11,530 transit fleet vehicles already use natural gas, and therefore have supporting infrastructure according to ARB's Discussion Document (p. 5, and Figure II-1.) Thus, in a fuel-neutral, performance-based alternative compliance scenario, the infrastructure transition cost would be significantly lower for fleets selecting a 0.02g/bhp-hr engine with renewable fuel compliance pathway than under a BEB/FCEB bus scenario. In addition, the natural gas fuel costs appear overstated in the Discussion Document as $2.55/diesel gallon equivalent for a transit agency operating its own fueling station. A natural gas fuel price of approximately $1.75/diesel gallon equivalent is more in line with transit agency CNG costs, based on recent discussions with local transit agencies. We respectfully request that ARB staff update the natural gas fuel costs with current and accurate fuel cost figures. By doing so, ARB will provide a cost estimate for transit fleets that better reflects natural gas fueling infrastructure costs and prevailing market conditions.

SoCalGas appreciates the hard work and effort exhibited by staff in developing the Discussion Document and the analyses contained therein. At the same time, we respectfully request that ARB re-evaluate its cost analysis as it relates to infrastructure and fuel for electric, hydrogen, and natural gas fueling in light of the information we have provided in these comments, as well as other sources of information available to ARB. ***Such informed analysis will provide the Board, elected officials and the public better data to appropriately evaluate the policy recommendations and implementation costs underlying the ACT regulation.***

D. The Discussion Document Emission Benefits Analysis Is Inconsistent

The Discussion Document notes the need to achieve the following performance goals:

- 90% reduction in NOx;
- 80% reduction in GHG emissions by 2050;
- Significant improvements in the use of renewable fuels and efficiency to meet 50% petroleum reduction by 2030; and
- Ongoing need to reduce diesel PM and air toxics to protect public health.[13]

The proposed ACT plan does not adequately demonstrate that the proposed proscriptive regulation (100% transition to battery and fuel cell buses) is the best solution for California, from a practical, technological, or cost perspective, to achieve the necessary emission reductions. Furthermore the performance data to date does not support that such a dramatic technology shift can deliver upon both the bus ridership demands, as well as the anticipated environmental outcome.

There is not an "apples-to-apples" comparison with hydrogen and other renewable fuels for GHG emissions. Although the Discussion Document assumes the 33% renewable hydrogen requirement, it also assumes that the natural gas bus market will utilize 100% conventional (not renewable) fuel, and does not include GHG impact calculations that include renewable natural gas alternatives, despite the fact that many California fleets are currently procuring renewable natural gas. Further, ARB assumes diesel is 100% conventional, and does not include GHG impact calculations that include renewable alternatives.

ARB also understates the emission reduction opportunity for near-zero emission engines with biomethane as anything other than an interim compliance method. The state has critical sustainability goals, including a 90% reduction in NOx, an 80% reduction in statewide GHGs, by 2050, and 50% petroleum reduction by 2030. In fact, ***ARB's own document*** notes that:

- Advanced low-NOx engines, that are anticipated to come into the marketplace by 2016, can achieve a 90% reduction in NOx (equal to ARB's emission reduction goal);
- Renewable fuels – including renewable NG – can achieve up to 78% reductions in GHGs when using landfill gas (which is approximately equal to the state's GHG goal);
- Renewable fuels entirely displace conventional petroleum (exceeding the state's petroleum reduction goal by 100%); and
- Near-term, lower-cost 0.02g/bhp-hr engine technologies plus renewable fuels distributed through existing fueling stations would enable transit agencies to achieve the state's goals using existing with minimal infrastructure and technology upgrade investments, and with no operational cost changes.[14]

As stated previously in these comments, SoCalGas and GNA are continuing to finalize our cost models to inform our analysis of the proposed ACT regulation. Yet, our initial cost-effectiveness

[13] Discussion Document, Executive Summary, p. i.
[14] Discussion Document, pp. 11-12.

calculations comparing possible BEB/FCEB rollout scenarios with a 100% renewable natural gas/near-zero engine alternative indicate that ***the more probable FTA funding levels will require Californians to spend approximately 30 times more per ton to achieve similar greenhouse gas reductions.***

At minimum, SoCalGas requests that ARB utilizes the carbon intensity values for alternative and renewable fuels as calculated using the most recent Low Carbon Fuel Standard analyses to demonstrate the potential GHG benefits to the state. In addition, we respectfully request that ARB include a full cost-benefit analysis of GHG and criteria pollutant reduction with all possible alternatives considered for advanced transit technologies, including the near-zero emission vehicles anticipated to be commercially available within the next two years. We also believe it would be beneficial to indicate transit's proportionate share of total NOx and GHG emissions to better assess the impact of this far-reaching regulatory proposal on statewide emission inventories.

As stated above, ARB must provide the best and more current data to support its proposed ACT regulation. ARB members, elected officials and the public will not be able to evaluate the efficacy of the proposed regulation without rigorous analysis to support the expenditure of billions of dollars on new, as'yet untested BEBs and FCEBs and supportive infrastructure. ***Such informed analysis is necessary appropriately evaluate ARB's policy recommendation, its environmental benefits, and implementation costs.***

E. Serious Commercialization Concerns Persist Regarding Zero Emission Tailpipe Buses

ARB has postponed its 15% zero emission bus purchase requirement several times due to commercial readiness concerns. The Transit Fleet Rule was adopted in 2000 with zero emission bus purchase requirements that phased in for larger fleets starting in 2008. The Zero Emission Bus Rule was amended in 2006 to include an advanced demonstration from the diesel path transit agencies, and to temporarily postpone the zero emission bus purchase requirement. The Board in 2009 through Resolution 09-49 directed staff to report back to the Board with an assessment of zero emission technology and its progress towards commercialization, and to develop commercial readiness metrics to be used for purchase implementation criteria to initiate the zero emission bus purchase requirement. This work will be completed as part of development of the ACT regulatory proposal.

Transit agencies and the public have not had a chance to review or comment upon the feasibility of these commercialization metrics and implementation criteria. The current discussion draft admits to major data gaps, which is to be expected based on a sample size of 22 BEBs and 7 FCEVs currently on California's roads.[15] These buses are largely in the demonstration and data gathering phase efforts. A product's demonstration and early commercial availability is not equivalent to the large scale commercial readiness for across-the-board fleet-wide implementation. And yet, based on this paucity of data, ARB staff is still recommending overhauling California's entire system of transit bus operation at a total estimated investment – for bus capital incremental costs alone – of several billion dollars over the life of this rule. Very

[15] ARB Discussion Document, p. 5, Figure II-1.

few BEBs have received Altoona testing to-date. This does not provide enough commercial-scale availability for the true mix of transit operations throughout the state. Twelve years is a critical benchmark for transit agencies, because FTA support is contingent on twelve years of operation. However, existing data gives no insight into the durability or true lifecycle performance of these buses.

Given the paucity of data, it may be premature to claim that these buses are commercially ready for a 100% mandate. None of the lifecycle costs projected in the ARB Discussion Document is drawn from large-scale, comprehensive, longitudinal data sources. None of the projections include any reference to accurate infrastructure costs. The FTA funding projections may be greatly overestimated and could undercut the true transit agency impact by at least several billion dollars in bus capital costs alone. Therefore, none of the cost analysis provided even hints at the true scope of the taxpayer cost to implement a zero tailpipe emission bus plan, nor what the long-term maintenance, operational, and ongoing bus purchase costs might look like for such a significant, comprehensive technology shift.

These costs do not account for the significant infrastructure, bus redundancy, operational, and other costs that will likely accrue to transit agencies and taxpayers. SoCalGas believes much more data collection, analysis and financial estimates are necessary to move the State from an ongoing hesitation about a 15% BEB/FCEB implementation target for large fleets to a sudden 100% implementation requirements for all State transit fleets based on the data gathered from a few limited product options and trials.

Conclusion

Thank you for this opportunity to comment. We look forward to continuing to discuss this proposed regulation with ARB staff, and hope for a fruitful exchange of information and ideas leading to a meaningful and cost-effective reduction in air emissions.

Sincerely,

Jerilyn López Mendoza

Jerilyn López Mendoza
Program Manager
Environmental Affairs

CC: Erik White, ARB
Craig Duehring, ARB
Patrick Chen, ARB
Lynsey Carmichael, ARB