Kevin Barker
Senior Manager
Energy and Environmental Policy
555 West 5th Street
Los Angeles, CA 90013
Tel: (916) 628-4921
KBarker@socalgas.com

October 18, 2021

The Honorable Liane M. Randolph
Chair, California Air Resources Board
1001 I Street
Sacramento, CA 95814

Subject: Comments on the 2020 Mobile Source Strategy

Dear Chair Randolph:

Southern California Gas Company (SoCalGas) appreciates the opportunity to provide comments on California Air Resources Board's (CARB's) upcoming October 28, 2021 public meeting to consider approval of the 2020 Mobile Source Strategy (2020 Strategy). We commend CARB Staff's focused efforts in determining pathways forward for the various mobile sources that are necessary to achieve carbon neutrality by 2045 and support near-term federal attainment deadlines. Importantly, decisive action can be taken today to maximize air pollutant and greenhouse gas emissions reductions as quickly as possible, thereby providing immediate reductions. Taking advantage of cost-effective and commercially available technologies, including a mix of advanced low-nitrous oxide (NOx) heavy-duty trucks and renewable fuels, can be more impactful than a single approach. SoCalGas' comments focus on heavy-duty trucks, specifically: (1) comparative analyses showing that a Class 8 Optional Low NO_x heavy-heavy duty (HHD) renewable natural gas (RNG) truck can significantly reduce emissions today; (2) utilizing RNG produced from waste biomass as a clean transportation fuel for heavy-duty trucks to help achieve State emissions reductions goals faster; and (3) opportunities for Optional Low NO_X RNG trucks in the 2018 San Joaquin Valley Supplement.

1. **Comparative analyses showing that a Class 8 Optional Low NO_x HHD RNG truck can significantly reduce emissions today**

For heavy-duty trucks, the 2020 Strategy focuses on a 100 percent Zero Emission Vehicle (ZEV) fleet for all trucks that are added to the statewide drayage truck registry starting in 2023.[1] As noted

[1] "Proposed 2020 Mobile Source Strategy," CARB, September 28, 2021, at 51. Available at https://ww2.arb.ca.gov/sites/default/files/2021-09/Proposed_2020_Mobile_Source_Strategy.pdf.

by stakeholders in CARB workshops and public meetings, ZEV technology is **not** commercially available to meet the needs of all duty cycles of the Class 8 HHD truck today. This was highlighted in the South Coast Air Quality Management District's (South Coast AQMD) August 3, 2021 letter to Partners in Environmental Justice and Environmental Health, in which South Coast AQMD stated that "there are substantial challenges regarding whether the duty cycles for ZE Class 8 vehicles can meet business needs, and whether a service network is available for businesses that acquire these vehicles."

CARB staff's ZEV approach, particularly for the HHD truck sector, does not result in the most health protective policy decision (greatest reduction of black carbon). Further, it overlooks the potential reductions in NOx and greenhouse gas (GHG) emissions that can be achieved today by Optional Low NO_X RNG vehicles. A 2021 peer-reviewed study by the University of California, Riverside found that HHD trucks fueled with RNG should be rapidly deployed in the 2020-2040 timeframe to achieve GHG and NOx emissions reduction targets.[2] We should not wait 10 years for technological feasible ZEV HHD options that may meet the needs of industry and bypass technology opportunities today that help achieve emission reduction targets.

The following comparative analyses of a Class 8 HHD truck powered by diesel, RNG, and electricity shows that a Class 8 Optional Low NO_X HHD RNG truck can generate greater reductions in lifecycle (well-to-wheel) GHG, NOx and diesel soot emissions than battery electric (BE) trucks when replacing a diesel truck. Table 1 (below) shows that one Model Year (MY) 2024 Class 8 Optional Low NO_X RNG HHD truck can reduce lifecycle GHG emissions by approximately 760 metric tonnes of carbon dioxide equivalent (MT CO_2e) over its ten-year lifetime as compared to its diesel counterpart, which is equivalent to taking almost 17 passenger vehicles off the road annually.[3] These GHG reductions are about 10 percent greater than those that can be achieved by replacing the diesel truck with a BE truck.

[2] Arun S.K. Raju, Barry R. Wallerstein, and Kent C. Johnson, "Achieving NOx and Greenhouse gas emissions goals in California's Heavy-Duty transportation sector," *Transportation Research Part D: Transport and Environment, Volume 97*, August 2021. Available at https://www.sciencedirect.com/science/article/pii/S1361920921001826.
[3] "Greenhouse Gas Equivalencies Calculator," US EPA, March 2021. Available at https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

Table 1. Class 8 HHD Trucks Well-to-Wheel GHG Emission Estimates for MY 2024[4]

Greenhouse Gas	Units	Diesel Truck	Optional Low NO_x Natural Gas Truck	Battery Electric Truck
Tailpipe Emissions[5,6]				
CO_2 Emissions	MT/truck	614	0	0
CH_4 Emissions	MT/truck	0.00108	0.704	0
N_2O Emissions	MT/truck	0.0967	0.112	0
BC Emissions	MT/truck	0.00211	0.00026	0
Tailpipe CO_2e Emissions	MT/truck	645	51	0
Upstream Emissions				
Upstream CO_2e Emissions	MT/truck	225	54	175
Total CO_2e Emissions	**MT/truck**	**869**	**105**	**175**
Reduction of CO_2e Emissions Compared to Diesel	MT/truck	--	764	694
Percent Reduction of CO_2e Emissions Compared to Diesel	-	--	**87%**	**80%**

As noted during the South Coast AQMD Board Retreat on September 16 and 17, 2021 CARB's proposed funding for a multi-year ZEV program begins with an initial installment of $3.9 billion for the first three budget years, which is a little over a one-billion-dollar investment per year.[7] To provide a comparison on what those funds could be used to achieve, Table 2 (below) considers investing a billion dollars in Optional Low NO_X RNG trucks or BE trucks, and then calculates the emissions reductions compared to an equivalent number of diesel trucks, respectively. Because a BE truck cannot haul the same amount as a diesel truck (weight and range limitations), the calculations in Table 2 assume that a single BE truck replaces only approximately 0.7 diesel trucks.[8] In addition, capital costs of BE trucks are greater than diesel trucks. Note that capital costs do not account for the additional costs of potentially expanding electricity generation, transmission, and distribution to charge the BE vehicles. Thus, a $1B investment in BE trucks will result in avoided diesel emissions from approximately 1,500 diesel trucks; approximately 2,000 BEVs would be needed to replace 1,500 diesel trucks, in contrast to Optional Low NOx RNG trucks that can replace diesel trucks on a one-to-one basis. **An investment of a billion dollars in**

[4] The tailpipe emissions of CO_2, methane, and black carbon were obtained from EMFAC2021 for a T7 Tractor Class 8 in California for Calendar Years 2024-2033. Lifetime emissions were integrated over an assumed vehicle lifespan of 10 years and activity level of 43,500 miles per year, based on the US EPA's definition of HHDT useful life and CARB's Low-NOx Omnibus Regulation. Upstream emission factors were calculated using the CA-GREET3.0 model for diesel and electricity generation. The electricity grid mix inputs to the model were adjusted based on California Energy Commission data for the current year and projections with renewables comprising 47 percent in 2023 and growing to 81 percent in 2037. RNG upstream carbon intensities were obtained from the LCFS program pathway lookup tables for the following RNG feedstocks: landfill gas, food wastes and animal waste/dairy digester gas. A weighted average of the carbon intensities is calculated based on the LCFS sales volumes in 2019-2020 before being used in these calculations.

[5] "Direct Global Warming Potentials: CO_2, CH_4, and N_2O GWP values," IPCC, 2007. Available at: https://archive.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html.

[6] "California's Black Carbon Emission Inventory," CARB, 2015 Edition. Available at: https://ww3.arb.ca.gov/cc/inventory/slcp/doc/bc_inventory_tsd_20160411.pdf.

[7] SCAQMD Governing Board Meetings, Agendas and Minutes for September 16 and 17. Available at http://www.aqmd.gov/home/news-events/meeting-agendas-minutes.

[8] *See* § 86.004-2 Definitions of the Code of Federal Regulations. Available at https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-86/subpart-A/section-86.004-2.

Optional Low NO_X RNG trucks in 2024 would deliver about 3 times more black carbon reductions, almost 3 times more lifecycle GHG reductions, and almost 3 times more tailpipe NO_X reductions (needed to meet the federal Clean Air Act Requirements) as compared to BE trucks. Even greater reductions can be achieved if the $1B investment is made for vehicle incremental costs only.

Table 2. Potential Emission Reductions in Investing $1 Billion in MY2024 Class 8 HHD Trucks

Truck Technology		**Optional Low NO_x RNG Truck**	**Battery Electric Truck**
Capital Cost for Single Truck[9]	**$/truck**	**$192,719**	**$489,448**
Number of Trucks Purchased	--	5,188 (replaces 5,188 diesel trucks)	2,043 (replaces about 1,500 diesel trucks)
Reduction of BC Tailpipe Emissions Compared to Diesel[10,11]	MT	9.61	3.08
Reduction of Lifecycle GHG Emissions Compared to Diesel	MT CO_2e	3,963,507	1,419,337
Reduction of NO_x Emissions Compared to Diesel	tons	5,042	1,719

2. Utilizing RNG produced from waste biomass as a clean transportation fuel for heavy-duty trucks helps achieve State emissions reductions goals faster

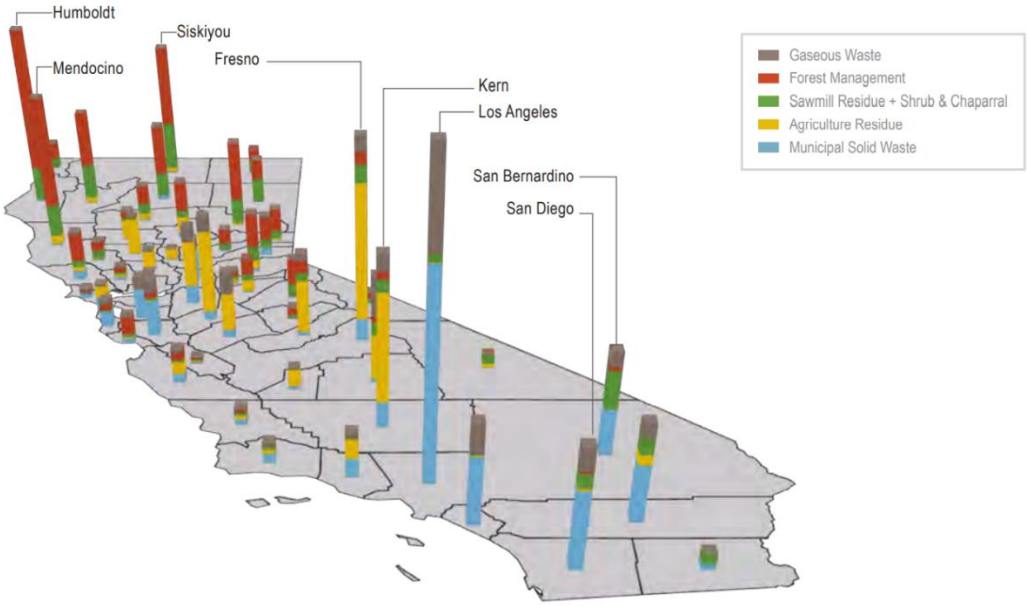
RNG is currently helping HHD trucks to reduce not only short-lived climate pollutants (SLCPs), but also criteria air pollutant emissions. CARB's Low Carbon Fuel Standard program[12] has certified several viable pathways for the conversion of fugitive methane emissions from landfills and animal waste into RNG that can be used to fuel Optional Low NO_X heavy-duty trucks. In fact, last year the GHG reductions from the use of RNG as a transportation fuel was equivalent to taking about 760,000 passenger vehicles off the road or reducing CO_2 emissions from approximately 394 million gallons of gasoline consumed.[13]

RNG production is a technologically feasible pathway to convert a significant portion of the State's organic waste streams, especially if thermochemical processes are applied on a large scale. RNG or biomethane is produced from raw biogas typically derived from organic waste streams such as dairy manure, landfill gas, municipal organic waste (*e.g.*, food scraps, lawn clippings, and animal and plant-based material), agricultural waste, forest debris, and wastewater treatment byproducts.

[9] "Ramboll Multi-Technology Pathways Study," WSPA, July 2, 2021. Available at https://www.wspa.org/resource/ramboll-multi-technology-pathways-study/. Note the total capital cost for a single truck is taken from this study.
[10] GHG emissions here include those contributed by black carbon. Values for black carbon and GHG reductions per truck are referenced from Table 1.
[11] "California's Black Carbon Emission Inventory," CARB, 2015 Edition. Available at: https://ww3.arb.ca.gov/cc/inventory/slcp/doc/bc_inventory_tsd_20160411.pdf.
[12] "Low Carbon Fuel Standard," CARB. Available at https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard.
[13] "Decarbonize Transportation with Renewable Natural Gas," RNG Coalition and NGV America, April 2021. Available at https://ngvamerica.org/wp-content/uploads/2021/04/Decarbonize-Transportation-with-RNG-Updated-April-16-2021.pdf.

According to a 2020 Lawrence Livermore National Laboratory study, this waste biomass is widely available across California, as shown in Figure 1 (below). In fact, approximately 56 million bone-dry tons of waste biomass is available annually statewide.[14] To put this into perspective, if the biomass waste was converted into electricity, it could support roughly 20 percent of the State's total electricity load.[15]

Figure 1. Assumed Contributions of Waste Biomass Across Counties and Resource Types[16]



Technologies are commercially available today to turn waste into RNG. Repurposing biomass power plants with these technologies could eliminate almost all criteria air emissions and "…provide a concentrated carbon dioxide stream that can be utilized to create more RNG or other by-products. Such a facility would provide a closed loop production system with very low net emissions while creating a storable renewable energy product that can be used like natural gas, delivered through a pipeline, with a very small carbon footprint."[17] Further, when waste is digested in biogas systems and the digestate effluent is returned to agricultural fields and spread like manure, the result is that the agricultural nutrients, like nitrogen, phosphorous and potassium, are

[14] "Getting to Neutral," Lawrence Livermore National Laboratory, August 2020, at 4. Available at https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf.
[15] Using the energy unit conversion factors of 1 bone-dry tons fuel produces 10,000 lbs of steam which can generate 1 MWh. Conversions are available at https://wood-energy.extension.org/energy-unit-conversion-factors/. CEC's California Energy Demand 2020-2030 Revised Forecast available at https://www.energy.ca.gov/data-reports/reports/integrated-energy-policy-report/2019-integrated-energy-policy-report/2019-iepr (states the statewide electricity total is 260 TWh).
[16] "Getting to Neutral," Lawrence Livermore National Laboratory, August 2020, at 4.
[17] "Low-Carbon Renewable Natural Gas (RNG) From Wood Wastes," GTI, February 2019, at 65. Available at https://www.gti.energy/wp-content/uploads/2019/02/Low-Carbon-Renewable-Natural-Gas-RNG-from-Wood-Wastes-Final-Report-Feb2019.pdf.

returned to the soil.[18] This is an improvement compared to sewer discharge of waste where soil nutrients and carbon are lost.

Use of RNG can provide fuel diversity benefits because it can be used as a drop-in fuel.[19] RNG can be deployed where it is needed via the existing gas pipeline infrastructure without the need for equipment or infrastructure changes.[20] It can also be available 24 hours a day and does not have the challenges that electric trucks face with charging infrastructure. Transitioning HHD trucks from diesel fuel to RNG trucks can provide significant reductions in fugitive methane emissions from landfills and dairy manure. Switching to Optional Low NO_x RNG HHD trucks is the most cost-effective and technologically feasible pathway to obtain appreciable GHG and criteria pollutant reductions over the next decade, starting today.

3. Opportunities for Optional Low NO_X RNG trucks in the 2018 San Joaquin Valley Supplement

CARB staff proposed a total of 10 tons per day of NO_X emission reductions by accelerating the turnover of 33,000 heavy-duty trucks to near-zero emissions or better, using incentives in the San Joaquin Valley by 2024. This was part of the 2018 San Joaquin Valley Supplement to the 2016 State Strategy for the State Implementation Plan (Valley Supplement). The Valley Supplement, approved by the CARB Board, along with the San Joaquin Valley 2018 PM2.5 Plan in January 2019, builds on the measures approved in the 2016 State SIP Strategy by including San Joaquin Valley specific measures. Although CARB has not adopted SIP creditable measures from the accelerated turnover of trucks, there is an opportunity to reduce real NO_X emissions by including Optional Low NOx RNG trucks in the 2020 Strategy. In fact, the 2020 Strategy sends a signal for the continued reliance on diesel powered HHD trucks until future technologies are functionally and operationally equivalent to current HHD trucks.

Conclusion

We appreciate CARB Staff's determination to propose mobile source scenarios. These scenarios "illustrate that even with extremely aggressive electrification, accelerated turnover, coupled with aggressive vehicle miles traveled reductions and fuel decarbonization, the mobile source sector alone cannot become carbon neutral by 2045."[21] Yet, there are technologies that are available today that can contribute immediately towards these efforts in a cost-effective manner. It is critical to utilize existing and commercially available technologies now to achieve emission reductions in the near-term, such as optional Low NO_X RNG trucks and utilization of biomass to produce RNG.

---

[18] "Producing Biomethane and Renewable Natural Gas (RNG) from Farm and Food-Based Biogas Systems," Ontario Ministry of Agriculture, Food and Rural Affairs, February 12, 2021. Available at http://www.omafra.gov.on.ca/english/engineer/facts/biomethane.htm.

[19] "Landfill Methane Outreach Program (LMOP): Renewable Natural Gas," United States Environmental Protection Agency, July 14, 2021. Available at https://www.epa.gov/lmop/renewable-natural-gas#:~:text=1%20Fuel%20diversity%20benefits.%20Use%20of%20RNG%20increases,at%20a%20landfill%20or%20anaerobic%20digestion%20%28AD%29%20facility.

[20] "Energy Systems," Intergovernmental Panel on Climate Change (IPCC), at 536. Available at https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter7.pdf.

[21] "Proposed 2020 Mobile Source Strategy," CARB, September 28, 2021, at 189.

We request that CARB Staff ensure that optional Low NO_X RNG trucks are considered and included as part of the suite of fuel/technology pathways that CARB pursues to achieve the State's long term climate goals and support attainment of federal ozone standards. Thank you for your consideration of our comments.

Respectfully,

/s/ Kevin Barker

Kevin Barker
Senior Manager
Energy and Environmental Policy