DATE: May 6, 2015

TO: SJVUAPCD Governing Board

FROM: Seyed Sadredin, Executive Director/APCO
Project Coordinator: Sheraz Gill

RE: **ITEM NUMBER 5: REVIEW AND APPROVE ACTION PLAN FOR PROMOTING THE USE OF NATURAL GAS TECHNOLOGY FOR GOODS MOVEMENT IN THE SAN JOAQUIN VALLEY**

RECOMMENDATIONS:

Review and approve the following action plan for promoting the deployment of natural gas vehicles and infrastructure in the San Joaquin Valley:

1. Support policy changes and legislation that help create a market for development, promotion, and deployment of near-zero emissions natural gas technology as follows:

    a. Currently, ARB's policy position is that only renewable natural gas is an option for addressing criteria air quality and GHG emissions mandates. The District recommends that ARB include conventional natural gas technology as an option to be pursued under the Sustainable Freight and other related state strategies.

    b. Ensure that Proposition 1B grant guidelines allow funding of currently available natural gas truck technologies.

    c. Support legislation that promotes the development and deployment of zero and near-zero emissions technology in the San Joaquin Valley.

2. Increase outreach efforts to communicate benefits and encourage transition to natural gas technology by Valley fleet operators.

3. Provide additional incentives for natural gas vehicles and infrastructure:

    a. Continue to fund new natural gas infrastructure through District's Public Benefit Grants Program.

    b. Provide higher incentives for natural gas truck technologies that meet near-zero optional emissions standards.

    c. Provide new incentives for fleet expansions with new natural gas trucks.

    d. Seek State AB 118 and Cap and Trade funding for the deployment of natural gas vehicles and installation of natural gas infrastructure.

4. Promote technology advancement for near-zero emissions natural gas technologies through the District's Technology Advancement Program.

5. Continue to evaluate and support as appropriate the development and deployment of hydrogen fuel cell technology in the heavy duty truck sector.

BACKGROUND:

Achieving attainment of EPA's increasingly stringent ambient air quality standards will require the development and implementation of transformative zero/near-zero emissions technology over the coming decades. Heavy duty trucks comprise the single largest source of emissions in the Valley and developing zero/near-zero technologies for this sector is vitally important to addressing the Valley's federal attainment challenges. Due to climate change concerns and a focus on near-port urban areas, much of the focus at the state level has been on advanced technologies that rely on electrification. In addition to the District's need to prepare new attainment plans to address the latest ozone and PM2.5 standards in 2016, the State Air Resources Board is also preparing a new Sustainable Freight Strategy that will establish a long term plan for transitioning to cleaner alternative fuels and technologies in the freight sector.

Given the enormous challenges the Valley still faces in meeting the criteria pollutant standards and the unique circumstances such as distance and elevation, natural gas may provide the more suitable and effective option for the Valley to pursue. The purpose of this item is to discuss strategies to elevate the priority for natural gas at the state level and to advance the deployment of advanced zero/near-zero emission natural gas vehicles and infrastructure.

DISCUSSION:

The challenges faced by the San Joaquin Valley with respect to air quality are unmatched by any other region in the state. The Valley's topography, climate, geography and the presence of two major transportation corridors connecting northern and southern California all contribute to the region's problem. With a high percentage of low-income and minority residents, a significant portion of the population in the Valley resides within established Environmental Justice areas, particularly within the Interstate 5 and Highway 99 corridors. More than 80% of the NOx inventory in the Valley is attributed to mobile sources, with heavy duty trucks as the single largest source of emissions. Furthermore, about 45% of all of the truck traffic within the four major trade corridors in the state occurs within the Valley.

Despite major reductions in emissions and corresponding improvements in air quality, the San Joaquin Valley continues to face difficult challenges in meeting federal ambient air quality standards. The latest federal air quality standards are now approaching the Valley's background levels, which will make it more difficult than ever for the District to demonstrate attainment of these standards in the future. Consequently, it is virtually impossible for the San Joaquin Valley to attain the new standards for ozone and particulates without the implementation of transformative measures, including significant advancements in zero/near-zero emissions technologies for mobile and stationary sources.

Recent statewide efforts to develop new freight technologies and a "Sustainable Freight Strategy" are intended to address ambient air quality mandates as well as state climate change mandates. However, these efforts have fallen short in identifying and prioritizing strategies in the intermediate period needed to attain federal air quality standards and protect public health, and have primarily focused on greenhouse gas reduction strategies.

Much of the state's investment in recent technology development and demonstration efforts has focused on electrification. With two major trade corridors running the length of the Valley, and much of the emissions challenge due to heavy duty freight trucks, zero and near-zero emissions truck technologies must be capable of meeting the challenges posed by the long distances and mountain ranges characteristic of the Valley. The development of zero emissions options for heavy duty trucking has been focused on short range applications. Development and demonstration of longer range zero emissions options, such as fuel cells, are just beginning and there is still uncertainty as to their technological achievability, economic feasibility upon commercialization, and ultimate pace of adoption.

Development of hybrid options that provide some of the benefits of zero-emissions are highly duty-cycle dependent. The benefits they provide largely occur when the vehicle is utilized in stop-and-go duty cycles. The nature of goods movement in the Valley through the corridors of I-5 and Highway 99 does not allow for stop-and-go duty cycles resulting in fewer opportunities for hybrid technologies to reduce emissions. Since the

benefits of hybrid technologies are lower for long-haul applications, there is less incentive for trucks to be developed and commercialized for that market further limiting the applicability of the technologies to local needs.

In stark contrast to electric heavy duty truck technologies, near-zero natural gas truck technology is already available commercially and has the potential to reduce emissions. With additional advances in technology in the near term, near-zero emissions natural gas truck technology could serve as a vital component of the state's strategy to bring transformational change to the goods movement sector. In addition to serving as a potential near-zero emissions technology in the near term, natural gas also provides for significant reductions in greenhouse gases, particularly in the longer term as renewable natural gas continues to be developed and brought to market.

Electric/Hybrid Technologies

Battery Electric: The most conceptually simple of zero-emissions technologies is battery electric, a device that stores electrical energy, processes it through a set of power electronics, and delivers it to traction motors that move the vehicle. This technology has shown to be highly promising in applications with the appropriate duty cycles. Batteries are highly efficient, which makes battery electric ideal for appropriate duty cycles.

The current state of battery technology limits the energy storage on a vehicle. Both energy stored per unit weight and energy stored per unit volume limit the overall capacity of battery electric vehicles. This presents a limit on the weight and range available for this technology. As the weight requirements of an application go up, the range limits for battery electric vehicles become more restrictive. For light duty vehicles, ranges can be hundreds of miles. In the medium duty size category applications such as package delivery and local service represent the longest ranges achievable with modern commercial batteries. For heavy-heavy duty, the range becomes severely limited. However, there have been some successes in certain fields, such as the yard truck demonstration funded by the District's Technology Advancement Program at the IKEA distribution center in Lebec. Other operations such as drayage are also well suited to this technology.

The efficiency of battery technology for storing and delivering power, coupled with the low cost of electricity makes a strong business case for this technology. However, long range over the road trucks would not be able to store enough energy with existing battery technology to achieve the emissions reductions needed. While ongoing advancements in battery storage are extending the range of applicability for battery electric, it is growing at a pace of about 6% increase in energy density per year, too slow to reasonably expect the technology by itself to make a significant impact on goods movement in the Valley.

Hybrid Vehicles: The limitations of battery electric technologies have led to the development and commercialization of hybrid technologies. There are a wide variety of

ways that hybrid technologies have been implemented. Hybrid systems range from those that primarily provide a method of recovering waste energy during processes like braking to systems designed to use electric drive exclusively with an engine that is only used to provide additional electricity beyond the limited range of batteries. One of the advantages of hybrid technologies is that they have been good platforms for growing the technologies that will ultimately be necessary for widespread zero emission adoption, and some of the technologies developed in this sector have even proved useful for conventional vehicles. For example, the electrification of vehicle accessories that has been necessary for some hybrid vehicles provide economy benefits in conventional vehicles as well.

The biggest benefit of hybridization technologies is the ability to recover waste energy, and the ability to decouple the engine operation from the vehicle operation allowing the engines to be used in their most optimal ways. However both of these benefits are highly duty cycle dependent. Vocations such as trash pickup, with frequent stops and starts, allow for very high fuel and emissions savings. However long-haul goods movement do not benefit greatly from these properties of hybrids. While operating at freeway speeds for long durations, trucks are generally operating near the optimal engine power levels, with little slowing or stopping and therefore no waste energy recovery opportunity.

Grid Connected Vehicles: One additional option for electrification is to grid-connect vehicles while they are in transit. A few different technologies have the potential for this type of range extension. One option is the use of overhead catenary power lines, in which trucks with electric traction, equipped with a pantograph to connect to the overhead power lines, would have the capacity to charge onboard batteries as well as receive the power needed for its motive power. There is a demonstration underway in Southern California of overhead catenary power lines, which is in the early phases of infrastructure development.

Additionally, there is potential for in-road technologies that could achieve the same goal of providing charging and motive power while in motion. Conductive systems would install a strip in the road that a vehicle could connect to and receive power. While similar to the “third rail” in an electric light rail system, the proposed technologies would have the capacity to identify where a vehicle is in its system and selectively power subsections of the conductive strip to prevent electrocution hazards from an active energy source in the ground.

There is also the possibility of an inductive power system that could power vehicles without any direct connection. Inductive charging systems are commercially available for light-duty electric vehicles making home charging simpler for end users, and transit bus demonstrations taking advantage of this type of system for stationary opportunity charging are being developed. If this technology is matured to allow for in-motion charging it could provide another option for grid connecting in-motion vehicles.

However, these systems require a significant change to the existing infrastructure, and upgrading the roadways in the Valley to take significant advantage of these options would be extremely costly and take a great deal of time. While the benefits of such systems may make them attractive, investments in these technologies will be extremely long term. One potential application of such a system could be to address targeted hot-spots of emissions. A system of this kind could be installed around areas where zero-emissions truck miles are desirable. For such a system to achieve large reductions, many of the vehicles using that section of road would have to have electric traction systems, either all-electric or hybrid-electric.

Natural Gas Technology

Natural Gas Emissions Benefits: Heavy-duty natural gas vehicles are cost-effective, commercially available, and provide fewer barriers to adoption than other zero or near-zero emission technologies. Natural gas is an abundant fossil fuel, but can also come from renewable sources. Natural gas is inexpensive and generally emits fewer criteria pollutants than diesel when combusted. Heavy-duty natural gas vehicles require minimal after treatment, which results in fewer vehicle components and less maintenance compared to the diesel equivalent. In addition, since natural gas vehicles are currently on the market, the presence of natural gas stations is steadily increasing, natural gas is cheaper than diesel. Finally, natural gas vehicles are more attractive than electric or fuel cell electric vehicles when considering the District's near to mid-term air quality goals.

With today's natural gas technology, NOx emissions from natural gas engines are well below the latest (2010) federal heavy-duty engine standard. Through a study commissioned by South Coast AQMD comparing natural gas and diesel engine emissions, drayage and class 8 trucks in various duty cycles demonstrated on average, that refuse and drayage natural gas trucks emit 3.7 times less NOx than their diesel counterparts. Similarly, heavy-duty natural gas trucks emitted 6.6 times less NOx. Additionally, it was noted that diesel trucks rely heavily on SCR performance in order to meet NOx standards. The optimal conditions required for perfect SCR performance may lead to higher NOx levels over time and varying duty cycles.

Over its lifecycle, from production to combustion in heavy-duty vehicles, natural gas results in a reduction of 25% in GHG emissions relative to diesel. In addition, renewable natural gas like biomethane not only reduces reliance on fossil fuels, but is 87% less carbon intensive than diesel and therefore further reduces GHG emissions. Natural gas also achieves significant reductions in black carbon emissions relative to diesel combustion. Black carbon has been reported by the ARB to be the second-leading contributor to global warming.

Natural Gas as a Near-Zero Technology Option: It is evident that natural gas engines consistently out-perform the current federal NOx standard for heavy duty trucks; however, there is no protocol for testing to a lower standard under the existing federal certification process. In 2014, ARB adopted an optional certification process for near-

zero engine technologies known as Optional Reduced NOx Emission Standards for On-Road Heavy-duty Engines. This process provides for the voluntary certification of engine technologies to emissions levels of 0.1 g/bhp-hr, 0.05 g/bhp-hr, or 0.02 g/bhp-hr NOx, representing 50%, 75%, and 90% reductions relative to the 2010 federal certification level. The 0.02 g/bhp-hr NOx optional standard for heavy-duty engines is equivalent to highly controlled power plant emissions that would result from charging an electric vehicle of a comparable size.

Providing these optional emissions standards helps provide engine manufacturers with an incentive to invest in near-zero emissions technologies currently unavailable through the existing federal certification process. New developments such as optimized compression ratios, enhanced three-way catalysts (TWC), improved aerodynamics, and low pressure storage will further reduce the emissions from natural gas engines and allow manufactures to reach the new optional emissions standards.

Improvements in natural gas engines in the past decade have resulted in improved efficiency and therefore improved ranges. These improvements have allowed early natural gas adopters who had previously relied on liquefied natural gas to allow for the necessary ranges to use compressed natural gas instead. Compressed rather than liquefied natural gas has advantages in access to infrastructure as compression can be completed on site from pipeline gas rather simply and with less energy than is required for liquefaction which is done at large facilities then trucked to fueling stations.

Hydrogen Fuel Cell Technology

In March 2015, your Board requested that the District provide an update on the current state of hydrogen technology and report back on its potential application for addressing the Valley's attainment challenges. Over the past several decades, hydrogen fuel cell technology has been perceived by some as a primary technology of choice for achieving zero-emissions from mobile sources. Fuel cells have the potential to provide the range necessary to allow for long haul operation in the heavy duty freight sector. Fuel cells are very efficient in extracting energy from hydrogen, much more than internal combustion engines are from conventional fuels. However, hydrogen fuel for vehicles is still in the early stages of development and large advancements must be made in order to be competitive with current technologies.

Major research efforts are continuing to make fuel cell vehicles more practical and comparable to other low-emission vehicles on the market; however, barriers to adoption of hydrogen fuel cell systems remain, principally the high cost of fuel and the lack of fueling stations. Through the development of more cost-effective production technologies and creation of a market for hydrogen fuel cells, the state of California and fuel cell proponents have been attempting to accelerate the development and deployment of H_2 technology.

State Hydrogen Highway: In April of 2004 by Executive Order (EO) S-07-04, Governor Arnold Schwarzenegger initiated the development of the California Hydrogen Highway

Network. This network is aimed at ensuring that enough H_2 fueling stations are in place to meet the growing demand of fuel cell vehicles. As of June 2014, there were 125 fuel cell electric vehicles registered with the California DMV. Auto manufacturers project the fleet will grow to 18,500 by 2020.

Today, the CEC continues to promote the development of fuel cell technologies through funding for a state hydrogen fuel station network. These efforts are supported by Assembly Bill 8 (AB 8), which allocates $20 million a year to the development of the Hydrogen Highway for the next ten years. Incentives under AB 8 include coverage of construction, operations, and maintenance costs for fuel station operators until such a time that the market becomes large enough to sustain itself. There are currently 9 fully operational hydrogen fueling stations in California with many more currently under construction. According to the state's Alternative Fuels Data Center, there will be 49 stations by the end of 2015 and 100 stations by 2020. Only one such station is planned for the San Joaquin Valley by 2015, located at Harris Ranch in Coalinga.

Hydrogen Fuel Production: Currently, there are a number of hydrogen fuel production technologies implemented on an industrial scale. These include natural gas reformation, electrolysis, and biomass gasification. In 2014, natural gas reformation made up 95% of centralized hydrogen production in the US. This process requires high-temperature steam to reform inexpensive natural gas like propane into its constituent H_2 and CO_2 components. The hydrogen is further purified, compressed, and stored for future use while CO_2 is recaptured to limit the GHG production. While this process is energy intensive, natural gas reforming is seen as the most viable near-term solution. It has enabled the construction of early hydrogen fueling infrastructure, which in turn supports research and development of more economical and efficient production technologies.

Advanced alternative fuel technologies are all dependent on economies of scale. The best way to continue to drive down prices is to increase supply. Additionally, there are emerging cost-effective production pathways that not only bring down the cost of hydrogen production, but increase the greenhouse gas benefits of the fuel through the use of renewable energy sources. Many common hydrogen production processes, like gas reforming or electrolysis, have the capacity to become renewable production pathways through the use of renewable electricity (e.g. solar power, wind power). There are even new innovative technologies like photoelectrochemical production, which uses highly specialized semiconductors to absorb sunlight and split H_2O, that have the ability to create completely renewable hydrogen at low-cost, but require further development and rely heavily on the success of early infrastructure and market growth.

Current State of Hydrogen Fuel Cell Technology: Consumers and businesses will feel more comfortable investing in new hydrogen technologies when there are clear indications that the market is sustainable. However, as demand for hydrogen grows and the investment in infrastructure helps create a larger market for these fuel cell vehicles, there is still the drawback of hydrogen fuel price. Depending on location, hydrogen fuel ranges from $10.00-$14.00 per kg H_2, which is the energy equivalent of

one gallon of gasoline. This price range includes production, compression, storage, and transportation. By 2020, the US Department of Energy and CEC aim for hydrogen prices around $4.00/kg, about the same as projected gasoline prices. For this goal to be realized, major steps must be made in reducing the cost of production. In addition, the current cost of hydrogen vehicles are significantly higher than conventional vehicles. The only commercially available fuel cell vehicles are light-duty passenger cars targeting early adopters; most notable are the Toyota and Hyundai models revealed earlier this year. At this time, the commercially available Hyundai Tucson fuel cell vehicle is only available for a 36-month lease for $499/month with $2,999 due at signing, which is significantly greater than the cost of the non-fuel cell version which is currently leasing for as little as $181/month.

While fuel cells show promise as both stand-alone energy sources and range-extenders for electric vehicles, it is clear that innovators in this field are focusing much of their energy on building capacity and infrastructure for light-duty use, and not for heavy duty equipment or trucks. Additionally, the vast price difference between fuel cell vehicles and conventional vehicles would only increase as the technology is introduced into the heavy-duty market, as these vehicles would require larger tanks and electric motors. Large strides must be made in developing fuel cell technology for heavy-duty applications.

PROPOSED ACTION PLAN:

The District recommends the following multi-faceted action plan for promoting the deployment of near-zero emission natural gas vehicles and infrastructure in the San Joaquin Valley:

1. ***Support policy changes and legislation that help create a market for development, promotion, and deployment of near-zero emissions natural gas technology as follows:***

    a. **Currently, ARB's policy position is that only renewable natural gas is an option for addressing criteria air quality and GHG emissions mandates. The District recommends that ARB include conventional natural gas technology as an option to be pursued under the Sustainable Freight and other related state strategies**

    The state is currently in the process of developing a new California Sustainable Freight Strategy that will establish a statewide strategy for establishing a "clean" freight system that meets the state's air quality, energy, and climate change goals. As part of developing this strategy, ARB has contended that only renewable near-zero emissions natural gas technology is a suitable option for addressing both air quality and climate change goals. While the District recognizes and supports the need for the advanced technologies presented in the strategy, precluding the use of non-renewable natural gas will further hinder

the adoption of natural gas vehicles and eliminate the only potentially viable intermediate option for addressing the Valley's attainment needs in the 2023 through 2032 timeframe.

As part of promoting the use of natural gas technology as a transitional technology for helping to address the Valley's heavy duty truck emissions, the District must work closely with ARB to fully evaluate and provide the appropriate credit for the GHG benefits associated with natural gas relative to other fuels.

As manufacturers design new heavy-duty engines, heavy-duty natural gas vehicles will continue to approach the near-zero emissions levels of electric and fuel-cell vehicle technologies. These cleaner emissions levels are not only achievable with non-renewable natural gas, but will be realized sooner than waiting for renewable gas production to reach the same industrial-scale availability of natural gas today. Furthermore, the District believes that disinvestment in non-renewable natural gas may actually hurt the adoption of the technology for both renewable and non-renewable natural gases, as it will slow down the development of the infrastructure needed for both and increase the cost of fuels. The Sustainable Freight Strategy emphasizes the importance of greenhouse gas emissions in the long term while failing to appreciate the near-term criteria pollutant mandates our region faces. Non-renewable natural gas is a necessary intermediate step that will reduce both greenhouse gas and criteria pollution while setting a path for renewable natural gas in the future.

b. Ensure that Proposition 1B grant guidelines allow funding of currently available natural gas truck technologies

ARB has recently proposed Proposition 1B grant funding guidelines that make it nearly impossible to fund non-renewable natural gas trucks. Pushing back the deployment of readily available conventional natural gas trucks by only supporting expensive renewable fuels will severely decelerate the adoption of natural gas technology in the Valley and state. As a program designed to specifically address the attainment challenges associated with goods movement emissions in the state, it is imperative that the Proposition 1B guidelines provide the flexibility needed to pursue and deploy currently available emission reduction technologies.

c. Support legislation that promotes the development and deployment of zero and near-zero emissions technology in the San Joaquin Valley

There are currently two legislative proposals that specifically target the deployment of near-zero emission heavy duty vehicles. AB 857 (Perea) would expand incentives, utilizing AB 118 funds, to support the deployment of clean low carbon heavy-duty vehicles involved in goods movement. AB 1074 (C. Garcia) would establish a state policy that refueling options need to be available to facilitate electric, hydrogen, and natural gas refueling along all passenger and

goods movement corridors. Additionally, the bill would require the California Energy Commission develop a refueling infrastructure plan that identifies station locations and facilities necessary to ensure that refueling options are available. Staff recommends supporting both bills in order to accelerate the deployment of zero and near-zero emissions heavy-duty vehicles in the San Joaquin Valley. As of the date of preparation of this memo, both AB 857 and AB1074 have passed through Assembly policy committees and will next be heard in the Assembly Appropriations committee.

2. Increase outreach efforts to communicate benefits and encourage transition to natural gas technology by Valley fleet operators

The conversion to natural gas by fleet operators and manufacturers is an involved process that can take years to implement. Changes to maintenance processes, refueling systems, driver education, and investment strategies are needed. Fleet operators are accustomed to and understand conventional fuel systems, creating a natural reluctance to switch to a different and more complex fueling structure. In addition, the lack of diversity of natural gas engine options compared to diesel has also led fleet operators to justify the continued use of diesel despite the benefits of natural gas.

In order to gain acceptance from fleet owners and manufacturers moving forward, the District will need to invest in significant outreach and education efforts to provide for a better understanding and need for natural gas technology. The District believes that with the appropriate incentives and outreach to Valley fleets on the economic benefits associated with natural gas trucks, there will be an accelerated transition to natural gas vehicles.

In March 2015, the CEC awarded CALSTART a grant under the Alternative and Renewable Fuel Vehicle Technology Program (ARFVTP) to develop a new center for alternative fuels and advanced vehicle technologies based in the San Joaquin Valley. Under District leadership, this new San Joaquin Valley Clean Transportation Center (SJVCTC) will be aimed at encouraging the development, demonstration, and deployment of various heavy-duty vehicle technologies with Valley businesses, cities, counties, and other entities. Through education, outreach, evaluation, and testing, CALSTART will work to reduce barriers that have prevented Valley fleets from adopting natural gas and other advanced technologies in the freight sector.

3. Provide additional incentives for natural gas vehicles and infrastructure

Providing incentives is an important component of promoting the use of natural gas vehicles due to the current lack of natural gas infrastructure and higher incremental costs for natural gas vehicles. The incremental cost of a natural gas truck can be as much as $60,000 more than a comparable diesel model. However, since the cost and maintenance of natural gas is less than diesel, there will eventually be a return on investment for the truck owner. Unfortunately, large fleets tend to turn their trucks over

every 4-5 years, and the cost differential between natural gas and diesel is currently much lower than in the past based on lower diesel fuel costs. Truck owners therefore have little time to realize the cost benefits of natural gas vehicles. New incentives to reduce the incremental cost associated with natural gas vehicles would help overcome this market barrier and begin to create a larger market for natural gas vehicles in the Valley. As more natural gas vehicles are deployed, a secondary used truck market would also be created in the Valley that would further assist in increasing the overall deployment of natural gas vehicles.

The District should also explore incentives for installing and maintaining fueling infrastructure in key transportation corridors throughout the Valley. Although the availability of natural gas fueling stations continues to improve, there are only 16 stations currently located in the Valley out of the 164 stations currently installed statewide, despite our disproportionate share of trucking miles and emissions. Constructing new stations is expensive due to the high cost of compressor equipment and fuel storage. Public fleets, such as school buses and refuse collection, have been early adopters of natural gas vehicles. As a result, much of the infrastructure development has been based on their locations. For much of the Valley's infrastructure, this limits the accessibility for long haul truckers. To effectively promote natural gas as a feasible technology for Valley fleet operators, it is clear that significant additional fueling infrastructure is required.

To address the above, staff recommends the following incentive-based actions:

a. **Continue to fund new natural gas infrastructure through District's Public Benefit Grants Program -** The District administers the Public Benefit Grants Program which was developed to bring direct benefits to Valley residents through local emission reduction projects implemented by local government agencies and public educational institutions. Under this program, public agencies can receive funding for the installation of new natural gas fueling infrastructure or expansion of existing infrastructure to support their vehicle deployment goals. One recent example of expanded fueling infrastructure under this program includes the construction of a new public-access LNG fueling station in partnership with the City of Lathrop.

b. **Provide higher incentives for natural gas truck technologies that meet near-zero optional emissions standards -** Under the District's Truck Voucher Program, the District currently provides up to 35% of the cost of a new 2010-certified truck, not to exceed $50,000. If desired by your Board, the District could explore and provide higher incentive levels for natural gas vehicles that meet the recently adopted near-zero optional emissions standards.

c. **Provide new incentives for fleet expansions with new natural gas trucks -** Currently, truck funding is essentially limited to replacement projects where an older vehicle is scrapped and a new vehicle is purchased. However, the District could support natural gas vehicle fleet expansion in which incentives could be

provided for new vehicle purchases without the requirement to scrap an existing vehicle. As with the above recommendation, higher incentive levels could be explored and provided for natural gas truck technologies certified to the near-zero optional emissions standards.

d. Seek State AB 118 and Cap and Trade funding for the deployment of natural gas vehicles and installation of natural gas infrastructure - A portion of Cap and Trade revenues should be allocated to provide funding for the replacement of existing trucks with natural gas trucks and the installation of new fueling infrastructure that result in reductions of both criteria pollutants and greenhouse gas emissions. This should be pursued both through administrative and legislative means.

4. Promote technology advancement for near-zero emissions natural gas technologies through the District's Technology Advancement Program

Your Board adopted the District's Technology Advancement Program in 2010 as a strategic incentive-based approach for identifying, demonstrating, and advancing the technologies necessary to address the Valley's air quality attainment challenges. Through the District's Technology Advancement Program, your Board recently awarded funding to The Gas Technology Institute, in partnership with Cummins Westport, Inc., to demonstrate an advanced ultra-low NOx natural gas engine certified to the cleanest optional NOx standard of 0.02 g/bhp-hr NOx. This optional standard is 90% cleaner than the cleanest engine certification standard currently in place. The project will include durability testing essential to the commercialization of the engine. The technology will be demonstrated in a heavy-duty truck and serves to prove that these optional standards are attainable in the near-term.

In upcoming Requests for Proposals (RFP), the District recommends tailoring the RFPs to provide for even greater emphasis for technology demonstration projects for near-zero heavy duty truck technologies used in the freight sector and that are likely to be viable in the near future to address the Valley's attainment needs, such as natural gas technology.

5. Continue to evaluate and support as appropriate the development and deployment of hydrogen fuel cell technology in the heavy duty truck sector

The District's analysis indicates that the fuel cell vehicle market is not near the point of commercializing heavy-duty fuel cell vehicles. However, in order to address ever-tightening federal standards that will require zero-emissions technology, it is still important to provide the appropriate support for the development, demonstration, and deployment of hydrogen as a potential zero-emission technology of the future. In evaluating the level of support moving forward, the District must continue to assess on an ongoing basis the potential viability of hydrogen technology in helping to address the Valley's attainment challenges, and provide support commensurate with this assessment. Your Board recently approved funding for two TAP projects that utilize

hydrogen fuel cells as range boosters for zero-emission heavy duty vehicles. These projects will assist in further developing hydrogen fuel as a potential future viable fuel source.