Chapter 6

Technology Advancement

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Chapter 6: Technology Advancement

[Note: The evaluation being conducted to develop this plan is an ongoing work in progress, and will continue to be revised and updated throughout the public process.]

The District Governing Board approved creation of the Technology Advancement Program on March 18, 2010. As an "extreme" non-attainment area for ozone, the District's *2007 Ozone Plan* contains a "black box" that represents necessary reduction in emissions for which a technology has not yet been identified. Staff developed the program to accelerate technology development that may provide additional emission reductions as part of the District's multi-faceted approach to attain increasingly stringent ozone and PM2.5 air quality standards. Meeting such standards will require significant advancements in low-emissions technologies from mobile and stationary sources. The program's adoption provides a strategic and comprehensive means to identify, solicit, and support technology advancement opportunities. Ongoing refinement of the program's technology focus areas will target efforts to achieve the greatest impact on the Valley's attainment of air quality standards as well as expedite the health-based goals of the *2012 PM2.5 Plan*.

The District's Technology Advancement Program will use the long-term need for the zero- and near-zero-emission transport of goods and people to inform near-term strategies to overcome the Valley's significant challenges. Such challenges are not completely unique to the Valley, nor are they isolated within the boundaries of the air basin. Strategies for reducing emissions in the Valley can be enhanced through partnerships and collaborations with other air districts and state agencies, including the development of technologies that benefit regional and state air quality. The District is currently collaborating with the California Air Resources Board and the South Coast Air Quality Management District to prepare a document to outline a common vision for attainment of federal air quality standards, as well as greenhouse gas goals and reduced exposure to toxics. The market penetration of transformative technologies will be a critical component of realizing a common vision and the Technology Advancement Program will help to identify and support upcoming technology opportunities.

6.1 TECHNOLOGY FOCUS AREAS

The District has structured the Technology Advancement Program to encourage participation within three focus areas:

I. **Renewable Energy**. Renewable energy projects are those that overcome the barriers to using renewable energy, such as remote solar energy/storage, vehicle-to-grid, wind energy, or peak shaving systems with zero/near-zero emissions technologies.

II. **Waste Solutions**. Waste solutions focus on waste systems or technologies that minimize or eliminate emissions from existing waste management systems and

processes, including waste-to-fuel systems, such as dairy digesters and other bio-fuel applications.

III. **Mobile Sources**. Mobile source projects include, but are not limited to, retrofit technologies for reducing particulate or NO_X emissions from heavy-duty trucks, zero/near-zero emissions goods movement solutions, clean alternative fuels (hydrogen, electric, etc.), vehicle hybridization, and efficiency improvements to on-road or off-road equipment.

These focus areas represent the current needs of the Valley; they also reflect the types of proposals previously received by the District within this and other programs. The District will continue to evaluate and update these focus areas as needed to respond to the Valley's air quality challenges.

6.2 FUTURE DEMONSTRATION PROJECTS

For the fiscal year 2012-2013, the District has committed an additional $8 million of funding for new demonstration projects. In addition to directly funding demonstration projects the District actively seeks opportunities to collaborate with technology innovators in seeking additional funding. An example of this type of funding is the District's administration of the zero-emission commercial lawn and garden technology demonstration funded with State Air Quality Improvement Program funds.

Moving forward, District staff will be searching for opportunities to support projects that build the air quality technology research and demonstration capacity of colleges and universities in the Valley. This emphasis will improve the ability of local institutions to engage in future clean-technology projects that are specifically suited to the Valley's needs. To accomplish this, staff will adapt the Technology Advancement Program scoring criteria so that projects that incorporate local colleges and universities will score higher in that category than those that do not.

6.3 DEMONSTRATION PROJECTS IN PROCESS

The District's Technology Advancement Program has had two rounds of funding and received over 60 proposals for clean technology projects. The District selected 18 of the proposed projects for funding for over $3 million in 2011. The following 11 projects, out of the 18 selected, are in process and moving forward:

Engine, Fuel, and Emissions Engineering, Inc. (EF&EE)
Rancho Cordova, CA
Renewable Energy and Waste Solutions Technology Focus Areas
The EF&EE project will demonstrate a compact SCR device on a biogas-powered engine to be installed at Joseph Gallo Farms in Atwater, CA. This technology is expected to reduce emissions from biogas-powered generation systems to ultra-low NOx levels. The system will include advanced monitoring and reductant metering equipment to prevent ammonia slip and reduce or eliminate the need for an ammonia

slip catalyst. The slip catalyst is the primary source of NO_X emissions in their current system, and the new system with advanced metering is expected to reduce NO_X emissions.

This new technology has a low cost relative to the anticipated emission reductions, resulting in good cost effectiveness. Additionally, the large amount of resource leveraging in the form of capital and the additional equipment invested in the balance of made this project a good candidate for funding. The technology being demonstrated has the potential to impact a large number of biogas projects in the Valley, and with statewide efforts being made to increase the number of biogas projects, this project is highly relevant to our planning process and offers additional co-benefits in greenhouse gas reductions.

Solar Storage Company
Redwood City, CA
Renewable Energy Technology Focus Area

The Solar Storage Company project will demonstrate a renewable solar-power generation system as an alternative to diesel power for agricultural irrigation pumping systems, especially those systems in remote locations. The demonstration system uses a thermal-solar concentration system with two reciprocating steam engines and a pressurized steam storage system. This technology will provide an alternative to electrifying pumping systems, which is not cost effective in situations where electricity is not close by or infrastructure is not in place. The project will be installed in parallel with a diesel backup-power system to operate the pump at times when there is a need for emergency freeze protection occurring with two cloudy days in a row. Meteorological conditions that prevent the solar use in such cases are rare and only accounts for 1% of the pumping time of a typical agricultural irrigation pump. As a result, the project will result in a 99% reduction in emissions including diesel particulates, NO_X, and greenhouse gasses.

This project has potential for reducing criteria pollutant emissions, as well as the potential to reduce greenhouse gases, while expanding renewable energy options. Successful demonstration of the technology may prove a low-cost thermal storage alternative for additional applications, thus reducing the barrier to adoption of solar thermal technology.

California Bioenergy
Dallas, TX
Renewable Energy and Waste Solutions Technology Focus Areas

The California Bioenergy project will optimize and expand the emissions control systems used at the Bidart Dairy digester in Bakersfield, California. The digester gas

system currently uses a non-selective catalytic reduction (NSCR) system. The project will tune the NSCR system to achieve very low NO_X emissions and install a second after-treatment system that uses hydrogen selective catalytic reduction to reach near-zero NO_X emissions.

The District is interested in the success of clean bioenergy production through the use of biowaste, particularly in terms of developing ultra-low-NO_X technologies to mitigate the potential impact from the large-scale development of these types of projects. Projects such as this one, if successful, move the Valley closer to that goal. The ability of digester projects like this to reduce greenhouse gas emissions provides co-benefits important for program acceptance.

US Hybrid Corporation
Torrance, CA
Mobile Sources Technology Focus Area

US Hybrid, in collaboration with CALSTART, will to convert a Terex OEM wheel loader to plug-in hybrid operation for fuel savings and emission reductions. Hybrid-electric technology, which is already available in the light-duty vehicle category, has only recently been applied to off-road vehicles. This project will advance the use of this technology for this off-road category and quantify the emission reductions associated with the system. The wheel loader will be tested at Maddox Farms, a dairy located in Fresno County. The hybridized vehicle includes electric-only operation, idle elimination, and power for electric attachments.

The outcome of this project has the potential to affect a large segment of the off-road vehicle emissions inventory and is very relevant to the attainment planning process. Additionally, the expected fuel savings will also reduce the long-term cost of ownership for the technology.

Electricore, Inc.
Valencia, CA
Mobile Sources Technology Focus Area

Electricore, Inc. will build and demonstrate a zero-emission, completely autonomous agricultural spray vehicle. Electricore will work with Trexa, LLC, who has developed a low-cost, commercial, electric off-road vehicle platform that will be combined with a

commercial orchard pull-rig agricultural spray trailer. Electricore will oversee the demonstration at Tech Agricultrual's farms outside of Buttonwillow, in Kern County. The vehicle will operate autonomously based on robotics developed by the Robotics Institute at Carnegie Mellon University.

Successful implementation of this technology could have an impact on the inventory of emissions from agricultural tractors, which are numerous in the Valley. Likewise, the reduced fuel usage and the associated greenhouse gas reductions provide co-benefits beyond criteria pollutant emissions reductions.

Sun-Maid Growers of California
Kingsburg, CA
Waste Solutions Technology Focus Area
Sun-Maid Growers will modify and test a mobile prototype device called the Burn Boss® Air Curtain Burner. Successful use of this device will reduce emissions resulting from the burning of paper raisin trays used during the grape harvest. The technology has been shown to significantly reduce visible smoke and NO_X emissions compared to open burning. The grape harvest coincides with District's highest ozone levels; reductions of these emissions greatly benefit air quality.

US Hybrid Corporation
Torrance, CA
Mobile Sources Technology Focus Area
US Hybrid, in partnership with CALSTART and Roush, will demonstrate a plug-in electric-hybrid propane utility truck using a Ford F-250 truck base. US Hybrid will demonstrate and test the utility truck at Maddox Farms near Riverdale, California. The demonstration and testing will identify NO_X emission reductions, greenhouse gas reductions, and fuel savings.

The outcome of this project has the potential to affect a large segment of the on-road vehicle emissions inventory, in light of the extensive use of utility truck in agriculture and other industries. Likewise, the reduced fuel usage, use of propane, and the associated greenhouse gas reductions provides co-benefits beyond criteria pollutant emissions reductions. The expected fuel savings will also reduce the long-term cost of ownership for the technology.

Leva Energy, Inc.
Santa Clara, CA
Waste Solutions Technology Focus Area
Leva Energy, Inc. will install and test two systems that recover wasted energy from ultra-low NO_X burners (ULNB). The system (Power Burner) integrates a gas-fired microturbine with a new ULNB into a system that can replace a burner on any boiler larger than 5 MMBtu/hr. The Power Burner recoups the energy lost with other ULNBs to cogenerate 100 kW of electricity with the same amount of fuel.

This technology's ability to provide boiler owners a faster payback on their investment has the potential to accelerate the adoption of ultra-low NO_X boilers in the valley and provide NOx emissions reductions in the short term. The use of waste heat to generate electricity provides co-benefits beyond emissions reductions.

City of Manteca
Manteca, CA
Mobile Sources Technology Focus Area

The City of Manteca will demonstrate two new Autocar Xpeditor E3 refuse vehicles fitted with Parker RunWise advanced series hybrid-drive technology to reduce diesel fuel consumption, associated NO_X, and other emissions, by up to 45%. The City will purchase the trucks from Autocar and subcontract with infoWedge to install monitoring equipment and collect data from the hybrid truck and a conventional diesel truck, for comparison purposes. infoWedge will characterize the drive cycle; monitor a 30-day demonstration of the hybrid truck; monitor and report emissions testing; and monitor long-term (6 months) demonstration to evaluate usage patterns, fuel consumptions, and maintenance needs.

Successful implementation of this project will show the ability to reduce emissions through reduced fuel use in the medium heavy-duty diesel truck off-road category. The reduced diesel fuel use also reduces greenhouse gas emissions and lowers overall, long-term operating costs for end users.

Association of Compost Producers
Julian, CA
Mobile Sources and Waste Solutions Technology Focus Area

The Association of Compost Producers will design and test an aerated static pile (ASP) method of composting for a large-scale composting facility. The system consists of three components: substitution of diesel-powered loaders with electronic conveyor systems to build piles; the use of solar-powered electric blowers to replace diesel-powered windrow turners during the active phase of composting; and the use of finished compost biofilter covers, which positively aerates the static piles.

Pacific Gas and Electric Company
San Ramon, CA
Mobile Sources Technology Focus Area

Pacific Gas and Electric Company will develop and demonstrate an extended-range, electric-drive Class-6 bucket truck with electric worksite operation capability. The system will improve on-road fuel efficiency and allow crews to work on-site without running the diesel engine. Emission reductions will be achieved by reducing

consumption of 4,895 gallons of diesel fuel per vehicle per year.

Because of the number of class-6 utility work trucks that operate in the Valley, this project has the potential to demonstrate significant emissions reductions in the on-road vehicle category. The reduced diesel fuel use also reduces greenhouse gas emissions and lowers overall, long-term operating costs for end users.

6.4 INTERAGENCY COLLABORATIVE DEMONSTRATION PROJECTS

In addition to projects selected through the request for proposals process, the District has partnered with other air quality agencies in the state to demonstrate new and emerging technologies.

Under-fired Charbroiler Emission Control Demonstration
South Coast Air Quality Management District (South Coast)
The South Coast is currently conducting a demonstration project focused upon control technology for under-fired charbroilers. A Program of Notice for this demonstration project was released by South Coast in October 2011, which solicited a number of proposals from control device manufacturers. District staff assisted in reviewing the submitted proposals, making recommendations on which manufacturers should be allowed to submit their device to the testing protocol at the University of California, Riverside College of Engineering - Center for Environmental Research and Technology (CE-CERT) test kitchen facility.

Through this technology demonstration effort, a viable control technology may be established that is both economical in its cost and efficient in its control of emissions from under-fired charbroiling. If this project is successful, the District could move toward regulating emissions from under-fired units in the San Joaquin Valley, bringing the area closer to attainment of current and future federal PM2.5 standards.

Zero-Emission Commercial Lawn and Garden Equipment Demonstration
California Air Resources Board
The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program would provide eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals (participants) who conduct business within the boundaries of the San Joaquin Valley. The cordless zero-emission lawn and garden equipment must be designated commercial-grade, generally used by commercial landscape professionals to complete multiple small to large gardening tasks over an eight-hour workday period. Eligible equipment may include, but is not limited to, lawn mowers, edgers, trimmers/brushcutters, hedge clippers, blowers/vacuums, sweepers, and chainsaws. The District expects to launch the program by July 2012 with a program completion date scheduled for May 2013.

Participating equipment manufacturers/vendors (technology demonstrators) would be responsible for providing the equipment; training to participants on the safe and efficient operation of the equipment and maintenance; and materials necessary for daily

operation. The participants would use the equipment in real world settings to verify equipment durability and performance, battery capacity, and battery charge time. In addition, the participants would be responsible for providing monthly data and feedback to the District and technology demonstrators and have the opportunity to keep the equipment upon submittal of all required data and information for the program. At the conclusion of the program, the District and the technology demonstrators would work together to complete a final report and submit the findings to ARB.

Natural Gas-Fired, Fan-Type Central Furnaces with Reduced NO_X Emissions South Coast Air Quality Management District

The South Coast is currently conducting a demonstration project focused upon prototype natural gas-fired fan-type central furnaces with reduced NO_X emissions. A Program of Notice for this demonstration project was released by South Coast in February 2010, which solicited a number of proposals from furnace manufacturers and gas industry technology developers in partnership with furnace manufacturers. This technology assessment of reduced NO_X central furnaces was initiated with the November, 2009 amendment of South Coast rule 1111. The District committed to financial support of the technology assessment in June 2010, and has provided $50,000 to the assessment.

The goal of this technology assessment is to demonstrate reduced NO_X furnaces capable of meeting an emissions goal of 14 nanograms NO_X per joule of useful heat. If this project is successful, the District could move with an amendment to District rule 4905 natural gas-fired, fan-type residential central furnaces, bringing the area closer to attainment of current and future federal PM2.5 standards.

6.5 FUTURE FOCUS AREAS FOR EFFECTIVE PLANNING

The District has structured its technology advancement and collaborative projects within focus areas that define the current needs and technology development activity of the Valley. Throughout the PM2.5 planning process and during plan implementation, the District will evaluate the effectiveness of control measures, the development of new technology, and the updated requirements for attainment of the federal standard. In this way, the District will be able to assess future program priorities and, if necessary, modify or change the technology focus area to best meet the challenges of the Valley.

The ongoing Under-fired Charbroiler Emission Control Demonstration Program and Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program are examples of how the District is responding to control measure and incentive program evaluation. During the planning process for Rule 4692 (Commercial Charbroiling), industry representatives raised concerns regarding the implementation costs and available technologies of possible controls. Such concerns, along with similar concerns within the South Coast Air Quality Management District, initiated development of Charbroiler Incentive Program (ChIP) to test potential new technologies. Likewise, while the District's Clean Green Yard Machine program has been successful within the residential sector, there was not effective and cost-effective technology to expand that

program into the commercial sector. In response, the District is now providing for hands-on testing and use of new commercial equipment.