



Chapter 7

Technology Advancement



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Chapter 7: Technology Advancement

The District Governing Board approved creation of the Technology Advancement Program in March 2010 to accelerate development of technologies that can help reduce air pollutant emissions in the Valley. Meeting EPA's increasingly stringent ozone and PM_{2.5} air quality standards will require significant advancements in low-emissions technologies from mobile and stationary sources. The Technology Advancement Program provides a strategic and comprehensive means to identify, solicit, and support technology advancement opportunities. Ongoing refinement of the program's technology focus areas targets efforts to achieve the greatest impact on the Valley's attainment and other health-based goals under the *2012 PM_{2.5} Plan* and the District's other ozone and PM_{2.5} attainment plans.

The Valley's air quality challenges are not completely unique to the Valley, nor are they isolated within the boundaries of the air basin. Technology development can benefit regional and state air quality. Strategies for reducing emissions in the Valley can be enhanced through partnerships and collaborations with other air districts and state agencies. The District is currently collaborating with the California Air Resources Board (ARB) and the South Coast Air Quality Management District (SCAQMD) 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.

7.1 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- or 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- or 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. Throughout implementation of this PM2.5 plan and future air quality plans, the District will continue to evaluate and, if necessary, update these technology focus areas to address to the Valley's air quality challenges.

7.2 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 continue to search 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 has adapted 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.

7.3 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. In 2011, the District selected 18 of the proposed projects for funding, for over \$3 million in support of clean technology demonstrations. 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 NO_x 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 equipment investment 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 convert a Terex 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 Agricultural'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 use 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 trucks 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 NO_x 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 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 reduce VOC emissions.

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.

7.4 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)

South Coast is currently conducting a demonstration project focused on control technology for under-fired charbroilers. South Coast released a program opportunity notice for this demonstration project in October 2011 to solicit 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 test kitchen facility.

This technology demonstration effort is testing promising prototype emission control devices, which will support future regulatory efforts at both South Coast and the District. As discussed in Chapter 4, reducing emissions from commercial cooking is critical for the Valley's attaining the 2006 PM_{2.5} standard, particularly in Kern County. In addition, as noted in Appendix D, reducing emissions from commercial charbroiling contributes to the District's Risk-based Strategy.

Zero-Emission Commercial Lawn and Garden Equipment Demonstration California Air Resources Board

The Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program will provide eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals (participants) who conduct business within the Valley. The cordless zero-emission lawn and garden equipment must be designated commercial-grade and 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 opened a Request for Applications on August 20, 2012 and expects a program completion date of May 2013.

Participating equipment manufacturers/vendors (technology demonstrators) will be responsible for providing the equipment; training to participants on the safe and efficient operation of the equipment and maintenance; and providing materials necessary for daily operation. The participants will use the equipment in real-world settings to verify equipment durability and performance, battery capacity, and battery charge time. In

addition, the participants will be responsible for providing monthly data and feedback to the District and technology demonstrators and may 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 will 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***

South Coast is currently conducting a demonstration project focused on prototype natural gas-fired fan-type central furnaces with reduced NO_x emissions. South Coast released a program opportunity notice for this demonstration project 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 for the demonstration project.

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. Based on the preliminary results of the South Coast furnace demonstration project, the technology required to meet new NO_x standards will be available by 2015. The District has committed to amend Rule 4905 in 2014 to lower the NO_x emission limits for residential furnaces and to examine the possibility of incorporating NO_x limits for natural gas-fired, fan-type, commercial central furnaces into the rule, with an anticipated compliance date of 2015. This demonstration project will be an integral component of the District's 2014 Rule 4905 amendment.

***Vision for Clean Air: A Framework for Air Quality and Climate Planning
South Coast Air Quality Management District and California Air Resources Board***

While the District's air quality challenges are significant, many aspects of those challenges are not unique, and they are not isolated to the boundaries of the Valley air basin. Strategies for reducing emissions in the Valley are enhanced through partnerships and collaborations with other air districts and state agencies. The District seeks out opportunities for such collaborations to build strong relationships and even stronger attainment strategies.

In 2011, ARB, with the assistance of the District and South Coast AQMD, developed the *Vision for Clean Air: A Framework for Air Quality and Climate Planning*. The goal of this collaboration is to draft a common vision for mobile and stationary source strategies that integrate the need to meet federal air quality standards for PM_{2.5} and ozone, the need to reach California's greenhouse gas goals, and the need to reduce public exposure to toxics (e.g. diesel particulates). This collaborative effort will take advantage of the efficiencies inherent in dealing with these three issues as inter-dependent problems with inter-dependent solutions.

Through the *Vision for Clean Air* effort, the three agencies have been evaluating pollutant reductions needed to meet overlapping air quality requirements for 2019, 2023, 2035, and 2050. These reductions will depend on the integration of transformative measures and emerging technologies (including zero- and near-zero emission goods movement) with long-range planning and control strategies. Critical to the attainment of targets will be the evaluation of the potential policies, legislation, infrastructure, and efficiencies that will ensure that South Coast, the Valley, and California are prepared to meet the long-term goals.

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