

Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment

Grant Number: G10-AQIP-14

Final Report

Funded by and prepared for the California Air
Resources Board

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Featured Cordless Zero-Emission Commercial Lawn and Garden Equipment:



I. Introduction

The District is pleased to submit this Final Report for the Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment (Demonstration Program) and appreciates the opportunity to work with the Air Resources Board (ARB), participating manufacturers and vendors (Technology Demonstrators), and program participants to implement the Demonstration Program in order to accelerate the deployment of new cleaner technologies. The Demonstration Program is funded through ARB using Assembly Bill 118 (AB118) Air Quality Improvement Program (AQIP) funds, with a required match from the District, for a total of \$500,000. The overall success of the Demonstration Program has allowed participating San Joaquin Valley commercial landscape professionals (Participants), which include private landscape businesses and public agencies, to conduct real world, in-use testing of cordless zero-emission commercial lawn and garden equipment (zero-emission equipment) and provide valuable performance data.

II. Goals and Objectives

The goals of the Demonstration Program are to allow Participants to gain hands-on familiarity with the zero-emission equipment and to permanently deploy zero-emission equipment to the commercial sector, which is still limited and their entry into the market is still in its infancy.

There are three main objectives of the Demonstration Program. The first is to allow real world testing of near-market ready products. By testing large numbers of products in commercial gardening operations, the manufacturer will have the data to examine the metrics regarding their products' performance, durability, and battery life. The feedback will give Technology Demonstrators the information to modify and improve the units, as necessary. The second objective is to place new technology in the hands of participating commercial landscape professionals who have not previously used zero-emission equipment. By becoming familiar with these competitive products and having the opportunity to provide data and comments on the zero-emission equipment without out of pocket costs, the District hopes the participants will continue to use the products after the program ends. The third objective is to promote market growth for the zero-emission products, which will provide measurable reductions in overall emissions emitted by the small commercial off-road engine category.

III. Program Methods

The District has completed each of the following milestones for the Demonstration Program, as required in the agreement with ARB.

A. Milestone 1: Executed ARB Grant Agreement and District Board Resolution

In June 2011, ARB awarded the District as the grant recipient of the Demonstration Program. The District's Governing Board approved the signed award agreement and resolution to accept ARB funds, provide match funding, and comply with Advanced Technology Demonstration Project on August 18, 2011. The District has submitted the signed grant agreement and resolution to ARB, as requested.

B. Milestone 2: Technology Demonstrator Agreements

The District partnered and contracted with several Technology Demonstrators through an open solicitation to provide zero-emission equipment to the Participants for in-use testing and reporting, as well as provide technical assistance necessary to operate the products.

District staff began the selection process for the Technology Demonstrators in December 2011 by conducting further research on available zero-emission equipment. In addition to discussions with potential manufacturers and vendors regarding zero-emissions equipment, the District held the Lawn Care, Landscaping and Air Quality Conference in March 2012, which focused on emission-reducing landscaping practices. The conference showcased developments in leading-edge, low-emission lawn care technology, and featured speakers and panel discussions by industry professionals.

Based on the information collected, District staff prepared a request for proposals (RFP) under the guidance of ARB staff to solicit interested manufacturers and vendors that would like to participate as technology demonstrators for the Demonstration Program. District staff also worked closely with ARB staff to address cost share concerns from the commercial landscape professionals, as many have expressed that they may not be able to participate with upfront costs, which would be in the form of a reimbursable deposit and returned to the participant upon program completion. In order to ensure that proper usage data is collected for the Demonstration Program, ARB staff requested that program participants provide a minimum reimbursable deposit as follows:

- 10% reimbursable deposit of total purchase price for public agencies (e.g. school districts, city parks and recreation departments, universities, etc.)
- 25% reimbursable deposit of total purchase price for private professional landscape businesses (including those that contract with public agencies)

The District would credit the Technology Demonstrators the remaining balance upon receipt of proper documentation during claim for payment and verification that the Participants have put a deposit down and received their equipment.

District staff finalized and issued the RFP to the public and a list of interested manufacturers/vendors on April 26, 2012. The RFP closed on May 29, 2012 with a total of five proposals from the following manufacturers and vendors:

- STIHL
- TMC Power Equipment, Inc.
- Mean Green Products, LLC
- The Greenstation
- EcoCut & Trim, Inc.

Upon review of the proposals, District staff determined the eligibility of the manufacturers and vendors, conducted further research into the offered pieces of zero-emission equipment and prepared the information for ARB's consideration and approval. The list of eligible pieces of equipment for the Demonstration Program is shown in Table 1 on the following page. A total of 23 zero-emission equipment, along with batteries and accessories, were made available for the Demonstration Program and include the following equipment categories:

- Mowers
- Blowers
- Sweepers
- Chainsaws
- Line Trimmers
- Hedge Trimmers

One of the technology demonstrators, EcoCut & Trim, Inc., had offered to provide several trailers with a signature charging station for the Demonstration Program, but the cost was prohibitive at more than \$20,000 per piece.

On August 16, 2012, District staff executed the agreements for all of the manufacturers and vendors identified above to participate as Technology Demonstrators (program partners) in the Demonstration Program.

Table 1 – Eligible Zero-Emission Equipment, Batteries and Accessories

Eligible Equipment by Model	Equipment Description
Mean Green Products	
CXR-62	Electric Zero Turn Mower
CXR-52	Electric Zero Turn Mower
WBX-33	Self-Propelled Walk Behind Mower
MGP-20	20" Push Mower
Side Discharge Plate	Mulching Plate for MPG-20 to Avoid Clipping Spread Out
Aluminum Grass Catcher	Side Discharge Chute for MGP-20 Clipping Containment
Aluminum Grass Catcher	Side Discharge Chute for WBX-33 Clipping Containment
LEM80	Lithium Energy Module for CXR-62 and CXR-52
LEM60	Lithium Energy Module for CXR-62 and CXR-52
LEM40	Battery for WBX-33
LEM20	Battery for MGP-20
LEM10	Battery for MGP-20
LEM 110V	110 Volt Battery Charger
LEMC30	LEM 80/60 Charger
LEMC10	LEM 10 Charger
LEMC12	LEM 20 Charger
TMC Power Equipment	
BPBL24V	Battery Powered Blower
BP0140	24V Battery Charger
PE12V24AB1	12V Battery
EcoCut & Trim	
"specialty item" Vacuum	Backpack Vacuum
"specialty item" Mower	Robotic Mower
Ryobi RY14110A	Self Propelled Mower
Ryobi RY40410	Blower
Ryobi RY40210	String Trimmer/Edger
Ryobi RY40610	Hedge Trimmer
Ryobi OP4026A	Lithium Ion Battery (spare)
LawnBott	Lithium Ion Battery (spare)
STIHL	
RMA 370	Walk-Behind Mower
BGA 85	Hand-Held Blower
MSA 160	12' Chain Saw
FSA 85	Straight Shaft Line Trimmer
HSA 65	Hedge Trimmer
4850 490 0100	Battery Belt
4850 491 0101	Additional Bag
4850 490 0301	Double Should Harness for Battery Belt
AL 300	Rapid Charger
AP 160	Battery
The Greenstation	
Lawn NC	Commercial Rated Lawnmower
Lawn N-2	Self-Propelled Lawnmower
Lawn N-1	Cordless Electric Lawnmower
Haaga 697	Mastersweep with Electric Drive
Haaga 497	Profi Sweeper
Haaga 677	30" Mastersweep with Electric Drive
Haaga 477	30" Profi Sweeper
Lawn N-1 & N-2 Battery	Additional Battery Charger for Lawn N-1 and N-2
Lawn NC Battery	Additional Battery Charger for Lawn NC
30 Ah Lithium Ion Battery	36V Battery for Lawn NC
20aH Battery	24V Battery for Lawn N-1 and N-2

C. Milestone 3: Participant Guidelines and Applications

During the process to solicit interested commercial landscape professionals to participate as end-users in the Demonstration Program, District staff worked with ARB staff to develop the end-user survey and to determine 1) applicant eligibility and 2) the cap on the total quantity and funding amount of the zero-emission equipment per project for the Request for Application (RFA).

In addition to the established percentage amount for the reimbursable deposits, each Participants was limited to one project based on the following equipment and funding amount:

- **Zero-Emission Equipment:** Maximum of 10 pieces per project
- **Program Funding:** Up to \$10,000 per project

Batteries, chargers, and accessories did not count towards the 10-piece equipment limit; however, the costs of those items were included in the maximum \$10,000 funding limit per project. In addition, the District only compensated the Participants for the number of batteries, chargers, and accessories that were considered necessary for the operation of the zero-emission equipment and up to the quantity recommended by the Technology Demonstrators.

Under ARB's guidance, the District issued the RFA on August 20, 2012 to the public, including landscape businesses, public agencies, and individuals that have expressed interest in the Demonstration Program. Since program funds were still available after the first closing period, the District extended the application period to October 1, 2012 to allow time for additional applicants to apply.

D. Milestone 4: Participant Contract

The District received a total of 73 applications for the Demonstration Program. By early November 2012, the District had allocated over \$492,000 for 62 Participants, which was well over the projected equipment funding amount of \$475,000. During the contracting phase, the District had to cancel several projects and work with the next available and interested applicants in the order the applications were received due to one of the following reasons:

- Applicant felt the refundable deposit was too large without knowing the equipment's durability.
- Applicant was under financial constraints.
- Applicant did not have additional funds for the high cost of the riding mower and did not want other available equipment.
- Applicant would be unable to meet or commit to program requirements.
- No responses from applicant.
- Applicant was not within the San Joaquin Valley or was ineligible.

However, several applicants from this group have expressed that providing the opportunity to test the zero-emission equipment was a good idea.

Per the contract, Participants for the Demonstration Program have agreed to provide an upfront reimbursable deposit to the Technology Demonstrators, test the zero-emission equipment and report to the District on a monthly basis regarding the products' battery life, performance and durability. The District executed most of the contracts in October and November 2012 and worked with the remaining five participants to execute their contracts through February 2013. District staff determined that one of the participants was not able to pay a reimbursable deposit and obtain their equipment for in-use testing in a reasonable timeframe. As a result, District staff had to cancel this single project in May 2013.

The Demonstration Program received participation from all eight counties within the San Joaquin Valley with a near equal distribution among the Northern, Central, and Southern regions. The overall total number of participants for the Demonstration Program is 60. Table 2 on the following page lists the Participants for the Demonstration Program.

Table 2 – Demonstration Program Participants

Project #	Organization	SJV Region	Count	Percentage
I. BUSINESSES			16	27%
C-20581	Turf Doctor Inc dba Weed Man	(Central) Fresno		
C-20596	Miller-Clark Landscape and Nursery Co, Inc.	(Central) Fresno		
C-20673	Green and Clean Landscaping	(Central) Fresno		
C-20642	Healthy Air Lawn Care Service	(Central) Madera		
C-20772	ACLS	(Central) Fresno		
C-20771	Mountainscapes Inc.	(Central) Madera		
C-20896	Evergreen Landscape Service	(North) Merced		
C-20894	Valley Crest Landscape Maintenance Inc.	(North) San Joaquin		
C-20595	Pioneer Landscape, Inc.	(North) Stanislaus		
C-20633	Silveira Lawn Care	(North) Stanislaus		
C-20644	Knock-out Landscape Services	(North) Stanislaus		
C-20908	Grover Landscape Services, Inc.	(North) Stanislaus		
C-20639	CCN Wholesale Nursery & Landscaping, Inc.	(South) Kern		
C-20808	Century Landscape, Inc.	(South) Kern		
C-20597	Tulare County Training Ctr for the Handicapped, Inc. dba ABLE Ind	(South) Tulare		
C-20632	Horticulture Solutions, Inc.	(South) Tulare		
II. PUBLIC AGENCIES			44	73%
C-20601	City of Mendota	(Central) Fresno		
C-20706	City of Fowler	(Central) Fresno		
C-20641	Fowler Unified School District	(Central) Fresno		
C-20671	Coalinga-Huron Joint Unified School District	(Central) Fresno		
C-20855	California State University, Fresno	(Central) Fresno		
C-20897	West Park Elementary School District	(Central) Fresno		
C-20904	Fresno Unified School District	(Central) Fresno		
C-20921	Kings Canyon Unified School District	(Central) Fresno		
C-21013	Clovis Unified School District	(Central) Fresno		
C-20922	California Department of Forestry and Fire Protection	(Central) Fresno		
C-20923	Fresno County Fire Protection District	(Central) Fresno		
C-20899	Malaga County Water District	(Central) Fresno		
C-20907	County of Kings	(Central) Kings		
C-21020	City of Lemoore	(Central) Kings		
C-20856	Hanford Elementary School District	(Central) Kings		
C-20592	City of Chowchilla	(Central) Madera		
C-20776	City of Livingston	(North) Merced		
C-20901	City Of Gustine	(North) Merced		
C-20852	Atwater Elementary School District	(North) Merced		
C-20895	Merced Union High School District	(North) Merced		
C-20910	Manteca Unified School District	(North) San Joaquin		
C-20900	San Joaquin County Parks and Recreation	(North) San Joaquin		
C-20775	City of Waterford	(North) Stanislaus		
C-20966	County of Stanislaus	(North) Stanislaus		
C-21012	City of Modesto	(North) Stanislaus		
C-20768	Denair Unified School District	(North) Stanislaus		
C-20649	Hughson Unified School District	(North) Stanislaus		
C-20767	City of Wasco	(South) Kern		
C-20773	City of McFarland	(South) Kern		
C-20853	Kern High School District	(South) Kern		
C-20854	Rosedale Union School District	(South) Kern		
C-20902	McFarland Unified School District	(South) Kern		
C-20920	Lakeside Union School District	(South) Kern		
C-20705	Bakersfield Association for Retarded Citizens, Inc.	(South) Kern		
C-20629	County of Kern Department of Airports	(South) Kern		
C-20704	City of Exeter	(South) Tulare		
C-20857	City of Porterville	(South) Tulare		
C-20643	Pleasant View Elementary School District	(South) Tulare		
C-20769	Exeter Union Elementary School District	(South) Tulare		
C-20770	Exeter Union High School District	(South) Tulare		
C-20809	Burton School District	(South) Tulare		
C-20905	Tulare City School District	(South) Tulare		
C-20906	Lindsay Unified School District	(South) Tulare		
C-21033	Earlilmart School District	(South) Tulare		
Project Total:			60	100%

E. Milestone 5: In-Use Testing Phase

The Participants' real world testing and recording of performance metrics began at different intervals in November 2012, which was based on when the each Participant returned the signed contracts to the District and when they ordered the zero-emission equipment with a refundable deposit to the respective Technology Demonstrators. As soon as the Participant's contracts were executed, District staff worked with the Technology Demonstrators on the equipment ordering process and issued the vouchers to the Participants, along with a copy of the executed contract. Upon receipt of the vouchers, Participants began the equipment ordering, delivery, and training process, as needed, with the Technology Demonstrators. During this period, District staff and the Technology Demonstrators worked with several participants, most of them public agencies, to address the delay in issuing checks for the reimbursable deposits.

Over 70% of the Participants were able to begin testing the zero-emission equipment by the end of December 2012 and provide monthly data in the form of surveys to the District. The final survey was due to the District by the end of May 2013. Please refer to Section IV (Results of the Demonstration Program) for further discussion on the usage data from the Participants.

F. Milestone 6: Quarterly Reports

ARB project management staff and District staff conducted a kick-off conference call in January 2012 to discuss the work plan, details of task performance, the project schedule, and address any questions or issues. ARB and District staff also held monthly conference calls for status updates, along with follow up discussions to address any concerns during the Demonstration Program.

As required in the agreement, the District has submitted all four Status Reports to ARB, which are attached as Appendix A to this Final Report.

G. Milestone 7: Final Report

The District is submitting this Final Report and all additional requested content to ARB for review and approval as a Final Report.

IV. Discussion & Results of the Demonstration Program

The District has worked closely with ARB staff, the Technology Demonstrators and Participants to successfully implement the Demonstration Program. The results of the Demonstration Program is discussed and presented below.

A. Summary of Funds

The following table summarizes the Budget Summary in accordance with the agreement with ARB and the actual total amount of funding allocated through the Demonstration Program.

Table 3 – Total Costs & Funding

Costs Category	AQIP Grant	Match Funding	Total	Actual Total
Equipment Funds	\$225,000	\$250,000	\$475,000	\$476,351.12 ¹
Administrative Funds	\$25,000	\$0	\$25,000	\$25,000 ²
Total	\$250,000	\$250,000	\$500,000	\$501,351.12

1. The additional equipment fund amount of \$1,351.12 was expended through the District's locally generated incentive funds.
2. The District has expended all Administrative Funds provided through AQIP Grant.

The breakdown in costs for the equipment funds is further explained in the Appendix B for the Technology Demonstrators and Participants.

B. Technology Demonstrators

The District appreciates the opportunity to partner with the five Technology Demonstrators, which consists of manufacturers and vendors, and recognizes the excellent customer service many of them have provided to the Participants through equipment orders and technical assistance.

From November 2012, District staff has continued to conduct several follow up calls and emails with the Technology Demonstrators regarding the status of the zero-emission equipment, to help address questions or concerns, and to resolve any pending issues. While District staff had the pleasure to work with the Technology Demonstrators to get the zero-emission equipment into the hands of the Participants, District staff has spent significant efforts and worked especially closely with EcoCut and Trim, Inc., as a vendor, to address their issue with obtaining the correct order of zero-emission equipment from the manufacturers, specifically the Ryobi equipment. In February 2013, District staff confirmed that two out of ten Participants received their equipment from EcoCut & Trim, Inc. for in-use testing. EcoCut & Trim, Inc. also notified District staff that they were unable to deliver the remaining zero-emission equipment to the remaining eight participants due to uncontrollable situations. As a result, District staff has worked with this group of Participants to order new zero-emission equipment from other Technology Demonstrators and to address the reimbursable deposits that they have already made with EcoCut & Trim, Inc. EcoCut & Trim, Inc. had agreed to pay the District the difference between the total reimbursable deposits collected and the claim for payment for services rendered to date. At the time this report was written, the District has not received payment from EcoCut & Trim, Inc.;

however, the Participants will be reimbursed for their deposits upon completion of the Demonstration Program.

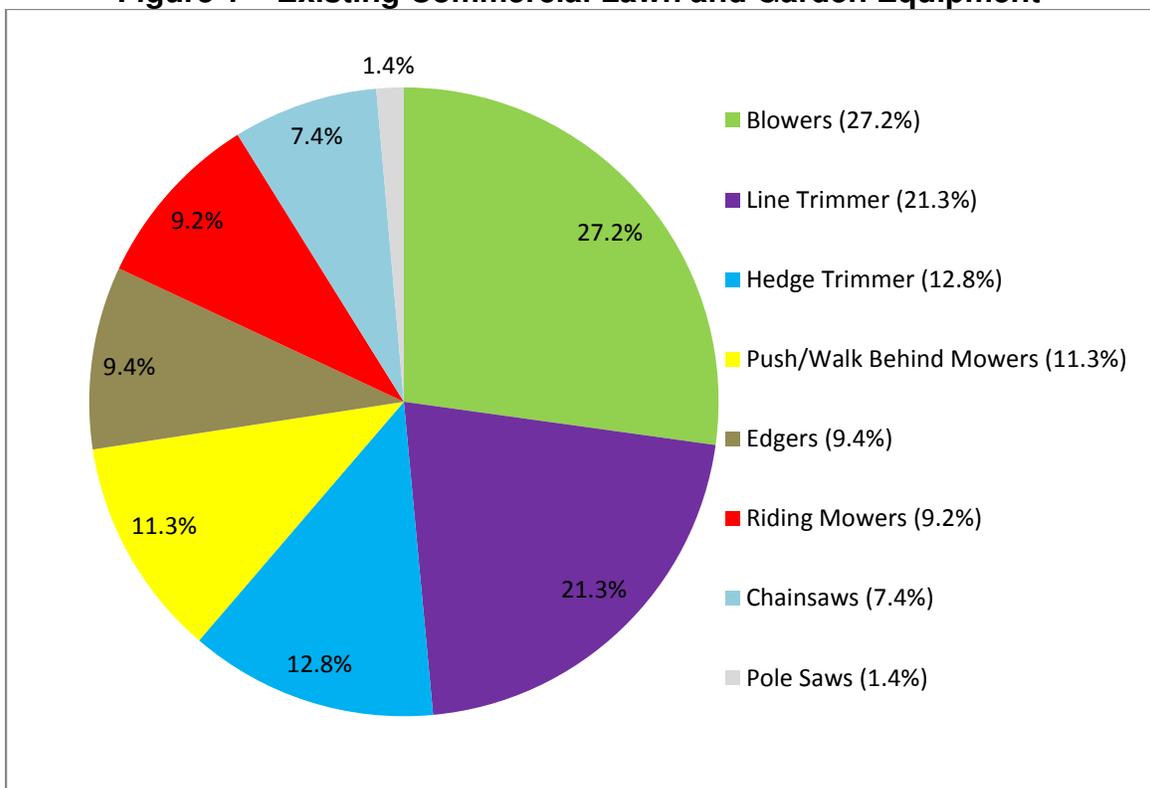
The Technology Demonstrators, Mean Green Products, STIHL, The Greenstation, and TMC Power Equipment, have all worked diligently with the Participants to get the zero-emission equipment ordered in a timely manner and to quickly address any issues regarding the zero-emission equipment.

C. Participants

1. Currently Owned Commercial Lawn and Garden Equipment

In order to help the District gain a better understanding of the type of equipment that are currently being operated in the commercial lawn and garden sector, the Participants provided information on their existing lawn and garden equipment, as summarized in Figure 1 below. The majority of lawn and garden equipment that the Participants currently own are gas and diesel powered.

Figure 1 – Existing Commercial Lawn and Garden Equipment



2. Zero-Emission Equipment for the Demonstration Program

With assistance from the Technology Demonstrators, the Participants received a total of 445 pieces of zero-emission equipment for in-use testing through the Demonstration Program. Participants were also provided accessories such as

batteries, chargers, and other related items for the batteries to properly test the zero-emission equipment during an eight-hour workday operation.

Since some pieces of zero-emission equipment were limited in quantity, the District allocated the zero-emission equipment to each of the Participants based on their selection on a first-come, first-serve basis. Some of the limited zero-emission equipment included mowers from Mean Green Products and the Lawn NC from The Greenstation. For example, Mean Green Products was able to provide only two riding lawn mowers for the Demonstration Program and many Participants have expressed interest in the riding lawn mowers. Figure 2 summarizes the percentage of zero-emission equipment used by the Participants

Figure 2 – Zero-Emission Equipment for the Demonstration Program

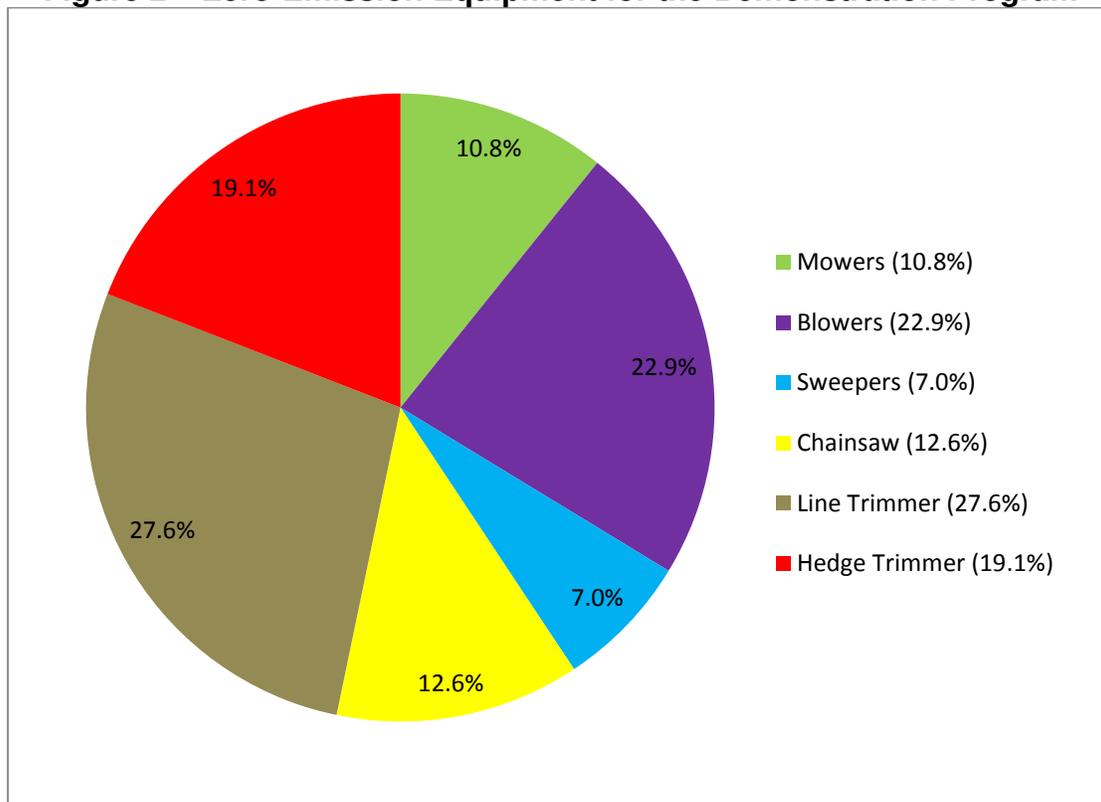


Table 6, below, shows the zero-emission equipment count for the Demonstration Program.

Table 6 – Total Number of Zero-Emission Equipment

Technology Demonstrator	Model	Description	Count
Mowers			
Mean Green Products	CXR-62	Electric Zero Turn Mower	1
Mean Green Products	CXR-52	Electric Zero Turn Mower	1
Mean Green Products	WBX-33	Self-Propelled Walk Behind Mower	5
The Greenstation	Lawn NC	Commercial Rated Lawnmower	3
EcoCut & Trim Inc.	Ryobi RY14110A	Self Propelled Mower	3
The Greenstation	Lawn N-2	Self-Propelled Lawnmower	14
The Greenstation	Lawn N-1	Cordless Electric Lawnmower	2
STIHL	RMA 370	Walk-Behind Mower	19
Blowers			
TMC Power Equipment	BPBL24V	Battery Powered Blower	26
STIHL	BGA 85	Hand-Held Blower	76
Sweepers			
The Greenstation	Haaga 697	40" Mastersweep with Electric Drive	9
The Greenstation	Haaga 497	40" Profi Sweeper	13
The Greenstation	Haaga 477	30" Profi Sweeper	9
Chainsaw			
STIHL	MSA 160	12' Chain Saw	56
Line Trimmer			
STIHL	FSA 85	Straight Shaft Line Trimmer	123
Hedge Trimmer			
STIHL	HSA 65	Hedge Trimmer	85
Accessories			
STIHL	4850 490 0100	Battery Belt	53
STIHL	4850 491 0101	Additional Bag	25
STIHL	4850 490 0301	Double Shoulder Harness for Battery Belt	42
Battery Chargers			
Mean Green Products	LEMC30	LEM 80/60 Charger	7
Mean Green Products	LEM 110V	110 Volt Battery Charger	7
TMC Power Equipment	BP0140	24V Battery Charger	23
STIHL	AL 300	Rapid Charger	308
The Greenstation	Lawn N-1 & N-2	Additional Battery Charger for Lawn N-1 and N-2	13
Batteries			
Mean Green Products	LEM80	Lithium Energy Module	10
Mean Green Products	LEM60	Lithium Energy Module	3
The Greenstation	30 Ah Lithium Ion	36V Battery for Lawn NC	2
STIHL	AP 160	Battery	626
EcoCut & Trim Inc.	Ryobi OP4026A	Lithium Ion Battery (spare)	3
The Greenstation	20aH Battery	24V Battery for Lawn N-1 and N-2	18
TMC Power Equipment	PE12V24AB1	12V Battery	20
Equipment Only			445
Total Equipment, Accessories, Battery Chargers, Batteries			1605

One of the goals mentioned earlier for this Demonstration Program was to allow real world testing of near-market ready products and collect usage data to examine the metrics regarding the products' performance, durability, and battery life. District staff contacted and worked with the Participants on a monthly basis to ensure that the surveys were turned in and that usage data collection was up to date. The Participants provided valuable comments and usage data for the

zero-emission equipment, which will give Technology Demonstrators the information to modify and improve the units, as necessary. The feedback from the Participants and information presented in this report are based on operations unique to each Participants only and are not reflective of the improvements that manufacturers are continuing to make on their products. As discussed with several Technology Demonstrators, some of the pieces of zero-emission equipment that were used for the Demonstration Program have already undergone improvements and are available on the market.

The raw data and feedback from the Participants are attached as Appendix C of this Final Report.

Table 7 below summarizes some of the comments received from the Participants.

Table 7 – Comments from Demonstration Program Participants

Model	General Comments from Some of the Participants
Mowers	
CXR-62	Mower is working great, is extremely quiet, and easy to use.
CXR-52	No comments received. See Table 8.
WBX-33	Performed well and would consider buying another one. Great service from Mean Green Products (Joe) for blade motor replacement.
Lawn NC	Mower worked really well, especially on dry lawns.
Lawn N-2	The mower does an awesome job, has nice cut, and is very light and maneuverable. Groundsmen are very pleased and Participant is receiving compliments from parents on using the equipment, which is very gratifying.
	Mower continues to be an under performer for Participant's usage.
Lawn N-1	The mowers work well on small areas.
	The equipment is not strong enough for the type of work the Participants do.
RMA 370	Participant uses mower on the smaller sections.
	Recommend the lawn mower to be a bit wider for efficiency and productivity. All battery operated is very durable and very light. Equipment performance is great, but for residential not commercial.
	There is no way it could effectively be used on a route due to the short battery life and time it takes to recharge. No ability to charge from vehicle even if it did take a shorter time to charge.
	Lawn mower bag to small, but good mulch.
	Mower is working good.
	Mower is good but they are not made for large commercial jobs like our 14 school sites. It takes longer to finish and we don't have the man power to lose time.
The unit is working great, my staff really likes the equipment.	
Ryobi RY14110A	Mower has a nice cut with light weight grass catcher set up, but very slow operation. Good for home owner, not institutional use.

The Participants' usage data is summarized in Table 8 below.

Table 8 – Summary of Participant’s Usage Data

Equipment Type	Equipment Model	Area(s) Worked	Vegetation / Debris Condition	Vegetation / Debris Characteristics	Type of Terrain	Time of Day	Battery Charging Location	Average Battery Charge Time (minutes)	Average Battery Run Time (minutes)	Average Number of Batteries Used During 8-hour Workday Period	Average Frequency of Charges for Each Battery Used During 8-hour Workday Period	Average Usage in hours per Month	Equipment Performance: E (for Exceed Expectations), A (for Acceptable), and U (for Unacceptable)			
													Ease of Use	Durability	Weight	Overall
Mowers	CXR-62	Fields	Dry, Moist	Thin Grass	Even	Morning, Afternoon	Shop	364.0	300.4	2.8	1.6	5.2	80% A 20% E	80% A 20% E	80% A 20% E	100% A
	CXR-52	Residential Yard, Parks, Districts Landscape	Moist	Medium Grass	Even	Morning, Afternoon	Public Works Yard	27.5	240.0	4.0	1.0	17.0	100% A	100% E	100% E	100% A
	WBX-33	Residential Yard, Fields, Hillside	Wet, Moist, Dry	Regular/Thick/Tall Grass	Hillside, Uneven, Even	Morning, Afternoon	Shop, Office, Trailer	74.5	100.5	1.5	1.4	15.7	18% A 82% E	14% A 86% E	23% A 77% E	50% A 45% E 5% U
	Ryobi RY14110A	Residential Yard, Fields, Campus Grounds	Moist, Dry	Tall/Thick Grass	Hillside, Uneven, Even	Morning, Afternoon	Office, Garage	290.0	50.8	1.6	0.9	60.3	100% A	100% A	17% A 83% E	100% A
	Lawn NC	Residential Yard	Moist, Dry	Tall Grass	Even	Morning, Afternoon	Shop, Office	303.2	125.8	1.3	1.3	22.0	67% A 33% E	67% A 33% E	100% E	43% A 57% E
	Lawn N-2	Residential Yard, Parks, Fields, Commercial Yards, Business Yards, Campus Grounds, Golf Courses, Corporate Facilities	Wet, Moist, Dry	Tall/Thick/Thin/Short/ Medium Grass	Hillside, Uneven, Even	Morning, Afternoon	Shop, Office, Trailer, Truck, Warehouse	403.2	47.1	2.1	1.2	20.8	8% A 81% E 11% U	36% A 58% E 6% U	22% A 78% E	22% A 64% E 14% U
	Lawn N-1	Fields, Corporate Yards, Golf Courses, Trees	Wet, Moist, Dry	Regular/Thick Grass, Dense Brush, Leaves	Uneven, Even	Morning Afternoon Evening	Shop, Office	556.4	58.3	1.6	1.0	19.4	7% A 14% E 79% U	64% A 15% E 21% U	86% A 14% E	14% A 14% E 72% U
	RMA 370	Turf, Residential Yards, Parks, Fields, Commercial Landscapes	Wet, Moist, Dry	Regular/Thick/Tall/ Tall Rye/Bermuda/ Grass, Turf	Hillside, Uneven, Even	Morning, Afternoon	Shop, Office, Mobile Station	154.1	36.6	4.5	1.7	16.1	63% A 33% E 4% U	56% A 20% E 24% U	47% A 53% E	37% A 43% E 20% U
Blowers	BPBL24V	Residential Yard, Concrete, Fields, Hallways, Shops, Eating Areas, Asphalt, Gated Area	Wet, Moist, Dry	Regular/Thick/Tall/ Hardscape Grass, Concrete, Dirt, Dust, Sidewalk, Asphalt, Shop Floors, Parking Lots, Pool Decks, Planting Area, Clippings, Trash	Hillside, Uneven, Even	Morning Afternoon Evening	Spider Room, Shop, Office, Yard, Pool Room, Store Room, Supply Room	213.2	90.5	1.8	1.4	11.3	44% A 30% E 26% U	39% A 23% E 38% U	30% A 31% E 39% U	24% A 33% E 43% U
	BGA 85	Concrete, Commercial Landscapes, Fields, Residential Yards, Parks, Campus Hallways Asphalt, Trees, Campus Grounds, Shop, Parking Lots	Wet, Moist, Dry	Dirt, Leaves, Damp Leaves, Light Debris, Cement, Wet/Thick/Tall Grass, Sidewalks, Shop Floor, Hardscape Planters, Clippings, Paper, Trash, Wood Chips, Campus Hallways, Black Top, Weeds	Hillside, Uneven, Even	Morning Afternoon Evening	Shop, Office, Garage, Truck, Custodian Closet, Store Room, Tool Room	116.6	29.1	2.8	1.7	17.3	49% A 49% E 2% U	61% A 33% E 6% U	53% A 42% E 5% U	49% A 31% E 20% U
Sweepers	Haaga 697	Residential Yards, Concrete, Asphalt	Wet, Moist, Dry	Leaves, Grass, Dirt, Dust, Debris, Paper, Sidewalk, Blacktop, Glass, Concrete	Uneven, Even	Morning Afternoon Evening	Office, Custodian Closet, Shop	190.1	52.8	1.4	0.8	16.4	57% A 43% E	90% A 10% E	75% A 25% E	49% A 42% E 9% U
	Haaga 497	Concrete, Shops, Asphalt, Residential Yards, Parking Lots, Fields, Garage	Wet, Moist, Dry	Leaves, Grass, Dirt, Debris, Paper, Sidewalk, Asphalt, Dust, Fertilizer, Kitty Litter	Uneven, Even	Morning Afternoon Evening	Store Equipment in Shop, Office. There are no Batteries to Charge.	No Batteries				8.0	41% A 39% E 20% U	47% A 33% E 20% U	60% A 33% E 7% U	51% A 26% E 23% U
	Haaga 477	Residential	Dry	Fertilizer, Debris	Even	Morning, Afternoon	N/A	No Batteries				16.0	100% E	100% E	100% U	100% U
Chainsaw	MSA 160	Trees, Fields, Shubs, Bushes, Parks, Buildings, Residential Yards, Orchards, Commercial Landscapes, Campus Grounds	Wet, Moist, Dry	Tree Branches, Fire Wood, Redwood Branches, Small Trees, 6" Caliper Tree Branches, Oleanders, Fotinia, Shrubs, Tree Limbs, Grass, Trunks, Hedges	Hillside, Uneven, Even	Morning Afternoon Evening	Shop, Office, Trailer, Truck, Tool Room, Mobile Station, Shed, Garage	167.0	56.6	2.9	1.6	17.1	19% A 79% E 2% U	39% A 57% E 4% U	26% A 74% E	34% A 61% E 5% U
Line Trimmers	FSA 85	Fields, Concrete, Residential Yards, Trees, Parks, Flower Beds, City Yards, Sidewalk Edges, Weeds, Commercial Landscapes, Campus Grounds, Medians	Wet, Moist, Dry	Tall/Thick/Rye/Dead Grass, Dense Bushes, Weeds, Thick/Thin Weeds, Leaves, Dirt, Branches, Lawn Edges, Plants, Branches	Hillside, Uneven, Even	Morning Afternoon Evening	Shop, Office, Yard, Store Room, Trailer, Shed, Back Room, Garage, Tool Room, Truck, Mobile Station	147.5	44.3	3.1	1.9	16.0	44% A 40% E 16% U	69% A 22% E 9% U	53% A 45% E 2% U	47% A 30% E 23% U
Hedge Trimmers	HSA 65	Residential Yards, Fields, Bushes, Hedges, Shrubs, Trees, Commercial Landscapes, City Yards, Planter Boxes, Oleanders, Ivy, Buildings, Vines, Campus Grounds	Wet, Moist, Dry	Hedges, Dense/Thick Bushes, Tree Branches, Shrubs, Ground Cover, Grass, Dense Oleanders, New Growth Bushes, Vines	Hillside, Uneven, Even	Morning Afternoon Evening	Shop, Office, Yard, Store Room, Trailer, Truck, Shed, Back Room, Garage, Tool Room, Mobile Station	136.4	50.8	2.7	1.5	15.3	32% A 67% E 1% U	50% A 49% E 1% U	36% A 63% E 1% U	47% A 47% E 6% U

V. Conclusion

The Demonstration Program has met all goals and objectives by allowing Participants to gain hands-on familiarity with the zero-emission equipment and demonstrating the benefit of a full scale commercialization of several pieces of zero-emission equipment. The overall funding amount expended for this Demonstration Program is \$501,351.12, with a total of 60 Participants and five Technology Demonstrators. To date, the District has paid out claims to the Participants and Technology Demonstrators for the zero-emission equipment.

The data and feedback from the Participants provided valuable information for ARB, District, and Technology Demonstrators to better understand the commercial landscape sector. Based on information received from the Technology Demonstrators and Participants, the battery life varies among different pieces of zero-emission equipment. The length of usage may also be based on the type of field work and how the zero-emission equipment is being operated. Data collection during the Demonstration Program shows that many Participants used multiple batteries or required more than one charge per battery to operate a piece of equipment during a typical work day. Additionally, the equipment usage by the Participants and is determined by, but is not limited to, the location, size, and season.

The commitments from both Technology Demonstrators and Participants throughout the Demonstration Program also helped provide immediate reductions of criteria pollutant and greenhouse gas emissions. Finally, the success of this Demonstration Program encourages the possibility of having future incentive funding sources for zero-emission equipment.

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Appendix A

Progress Reports

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San Joaquin Valley Unified Air Pollution Control District

January 18, 2012

Project Title: Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment

Grant Number: G10-AQIP-14

Grantee: San Joaquin Valley Unified Air Pollution Control District (District)

Issuing Agency: California Air Resources Board (ARB)

Technology Demonstrator(s): To Be Determined

STATUS REPORT

On January 12, 2012, ARB and District staff conducted a review meeting to discuss progress on this project. As a follow up from the meeting, this status report is being transmitted to ARB to satisfy the reporting requirements.

District staff is actively working on the 'Milestone 2: Technology Demonstrator/Vendor Agreement(s)' part of the contract. At this time, District staff is conducting further research on available cordless zero-emission commercial lawn and garden equipment technologies and developing a request for proposal (RFP) to solicit equipment manufacturers and vendors as potential technology demonstrators. As part of the upcoming tasks, District staff has communicated with interested vendors and plan to finalize a contact list for the RFP. District staff will notify ARB after the solicitation period closes and work with ARB staff in selecting a technology demonstrator(s)/vendor(s). The second milestone is expected to be completed by March 2012 with ARB's approval of a technology demonstrator(s).

San Joaquin Valley Unified Air Pollution Control District

June 4, 2012

Project Title: Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment

Grant Number: G10-AQIP-14

Grantee: San Joaquin Valley Unified Air Pollution Control District (District)

Issuing Agency: California Air Resources Board (ARB)

Technology Demonstrator(s): To Be Determined

STATUS REPORT

In addition to the District's monthly meetings with ARB, this status report is being transmitted to ARB to satisfy the reporting requirements.

The District has worked closely with ARB to address cost share concerns for the landscape operators. Under ARB's guidance, the District developed a request for proposals (RFP) for equipment manufacturers/vendors that would like to participate in the program as technology demonstrators and issued the RFP on April 26, 2012. The RFP closed on May 29, 2012 with a total of five proposals from the following manufacturers/vendors:

- Stihl
- TMC Power Equipment, Inc.
- Mean Green Products, LLC
- Greenstation
- EcoCut & Trim, Inc.

At this time, District staff is reviewing the submitted proposals and will prepare information on potential technology demonstrators and commercial lawn and garden equipment for further discussion at the June 14, 2012 meeting with ARB staff. Upon ARB's approval, District staff plans to issue contracts to selected technology demonstrators.

District staff also plans to work with ARB staff to determine applicant eligibility (such as providing a cap on the quantity and total value of equipment for each applicant) and to develop a data collection survey specific to the program.

District staff expects to launch the program with the technology demonstrators and participants by July 2012.

San Joaquin Valley Unified Air Pollution Control District

November 5, 2012

Project Title: Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment

Grant Number: G10-AQIP-14

Grantee: San Joaquin Valley Unified Air Pollution Control District (District)

Issuing Agency: California Air Resources Board (ARB)

Technology Demonstrator(s): EcoCut and Trim, Inc.
Mean Green Products, LLC
STIHL, Inc.
The Greenstation, LLC
TMC Power Equipment, Inc.

STATUS REPORT

In addition to the District's monthly meetings with ARB, this status report is being transmitted to ARB to satisfy the November 2012 reporting requirements.

For the months of June through July, District staff reviewed the proposals from five manufacturers/vendors and conducted further research into the pieces of equipment that were offered for the demonstration program. On June 14, 2012, District staff provided ARB a list of all the cordless zero-emission lawn and garden equipment and the names of the five applicants that the District felt met the requirements of the demonstration program for review and approval. Per ARB's approval on June 21, 2012, District staff began working with the following technology demonstrators to execute the agreements and to further develop the demonstration program:

- Stihl
- TMC Power Equipment, Inc.
- Mean Green Products, LLC
- Greenstation
- EcoCut & Trim, Inc.

In addition, District staff worked with ARB to develop the end-user survey and to determine 1) applicant eligibility and 2) the cap on the total quantity and funding amount of the equipment per applicant.

On August 16, 2012, District staff executed the agreements for the technology demonstrators, identified above. With ARB's guidance, the District issued the Request for Application on August 20, 2012 to interested landscape businesses, public agencies, and other individuals on the District's contact list. Several technology demonstrators also provided assistance with the outreach efforts.

The District extended the application period from September 20, 2012 to October 1, 2012 to allow time for additional applicants to apply. At the time of this status report, the District has allocated a total of \$492,432.54 of project funds to 62 participants. The District has completed the application review and selection process and is currently finalizing the contract and equipment purchase phases with all of the participants. As of November, some participants have already received their equipment and have begun the testing and data collection phase.

For the upcoming months, the District will be receiving claims from the technology demonstrators for the remaining costs of the equipment. District staff will be working with both the participants and technology demonstrators to address any issues and collect monthly data.

San Joaquin Valley Unified Air Pollution Control District

May 28, 2013

Project Title: Advanced Technology Demonstration Project: Cordless Zero-Emission Commercial Lawn and Garden Equipment

Grant Number: G10-AQIP-14

Grantee: San Joaquin Valley Unified Air Pollution Control District (District)

Issuing Agency: California Air Resources Board (ARB)

Technology Demonstrator(s): EcoCut and Trim, Inc.
Mean Green Products, LLC
STIHL, Inc.
The Greenstation, LLC
TMC Power Equipment, Inc.

STATUS REPORT

Along with District staff's monthly meetings with ARB staff, this final status report is being transmitted to ARB to satisfy the project reporting and disbursement requirements.

From November 2012 through May 2013, District staff has worked with the participants and technology demonstrators to get cordless zero-emission lawn and garden equipment purchased and out to the field for in-use testing as soon as possible. District staff has also continued to collect data via monthly surveys from the participants, with the last survey due to the District on May 30, 2013.

To date, majority of the participants are in good standing with the required monthly surveys and District staff is in the process of compiling the data for the final report to ARB. The total amount of program funds allocated has been updated to \$476,654.27, with a total of 60 participants. The amount of funding allocated to each project for equipment ordered is summarized in Appendix A. The District has paid out most of the claims to the technology demonstrators, with a few outstanding claims for STIHL and The Greenstation.

Since the last status report, District has cancelled two participants after several efforts to contact them to help get their projects moving: one participant was unresponsive to the draft agreement issued to them and another participant did not follow through with ordering their equipment.

District staff has also spent significant efforts to resolve several issues from one of the technology demonstrators, EcoCut and Trim, Inc (EcoCut). As discussed with ARB staff, EcoCut did not follow through with the equipment order for eight out of ten participants: Hughson Unified School District, County of Stanislaus, City of McFarland, Weed Man, Malaga County Water District, City of Livingston, Fowler Unified, and Clovis Unified School District. As a result, staff has continued to work with those participants and other technology demonstrators to order new equipment and ensure they have an opportunity to participate in the program and help collect data. Additionally, EcoCut has collected the reimbursable deposits from seven of the participants above and District staff is working on collecting the outstanding balance from EcoCut to reimburse the participants.

The issues above are being resolved and District staff expects to expend all funds allocated for this program. At this time, District staff is wrapping up the demonstration program and plans to submit a draft final report to ARB during the first week of June 2013.

Appendix B

Invoices

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Summary of Funding and Invoices Paid to Technology Demonstrators & Participants

1. Technology Demonstrators

As mentioned, the Participants were responsible for a minimum reimbursable deposit amount to the Technology Demonstrators of 10% or 25% of the total purchase price of the zero-emission equipment, based on whether the organization is a public agency or private professional landscape business. As a result, the District allocated the remaining balance to the Technology Demonstrators and has issued all outstanding claim for payments to them, as appropriate. The total amount issued through this Demonstration Program for each of the Technology Demonstrators is as follows:

Table 4 – Total Equipment Funds Paid to Technology Demonstrators

Project No.	Technology Demonstrator	Amount Paid
C-20386-A	EcoCut & Trim, Inc.	\$2,382.72 ¹
C-20354-A	Mean Green Products, LLC	\$39,342.43
C-20392-A	STIHL, Inc.	\$299,246.86
C-20390-A	The Greenstation	\$59,640.48
C-20391-A	TMC Power Equipment, Inc.	\$15,121.36
Total		\$415,733.85

1. Funding amount allocated to EcoCut & Trim, Inc. for services rendered. See explanation for EcoCut & Trim, Inc. below.

2. Participants

The total amount of equipment funds that the District had issued to the Participants is \$60,617.27. Table 5, below, shows the amount for each of the Participant. The amount shown is the reimbursable deposits that the Participants were responsible for, based on the total purchase price of the zero-emission equipment, and include only the reimbursable deposit amounts for zero-emission equipment that have been purchased and used out on the field.

Per ARB approval, no additional deposits were required to purchase the new zero-emission equipment for the Participants that have already given a deposit, but did not receive any zero-emission equipment from EcoCut & Trim, Inc. The District has paid the Technology Demonstrators directly for the new equipment and will issue checks to this group of Participants through a separate District fund in the total amount of \$3,679.33.

Table 5 - Total Equipment Funds Paid to Participants

Project #	Organization	Funding Amount
C-20592-A	City of Chowchilla	\$1,000.00
C-20595-A	Pioneer Landscape, Inc.	\$2,500.00
C-20596-A	Miller-Clark Landscape and Nursery Co, Inc.	\$2,126.36
C-20597-A	Tulare County Training Ctr for the Handicapped, Inc. dba ABLE Ind	\$2,049.21
C-20601-A	City of Mendota	\$921.89
C-20629-A	County of Kern Department of Airports	\$1,000.00
C-20632-A	Horticulture Solutions, Inc.	\$2,457.33
C-20633-A	Silveira Lawn Care	\$2,064.68
C-20639-A	CCN Wholesale Nursery & Landscaping, Inc.	\$1,579.39
C-20641-A	Fowler Unified School District	\$479.68
C-20642-A	Healthy Air Lawn Care Service	\$852.45
C-20643-A	Pleasant View Elementary School District	\$1,000.00
C-20644-A	Knock-out Landscape Services	\$433.20
C-20649-A	Hughson Unified School District	\$1,000.00
C-20671-A	Coalinga-Huron Joint Unified School District	\$1,000.00
C-20673-A	Green and Clean Landscaping	\$2,500.00
C-20704-A	City of Exeter	\$996.52
C-20705-A	Bakersfield Association for Retarded Citizens, Inc.	\$801.30
C-20706-A	City of Fowler	\$1,000.00
C-20767-A	City of Wasco	\$988.76
C-20768-A	Denair Unified School District	\$983.84
C-20769-A	Exeter Union Elementary School District	\$875.45
C-20770-A	Exeter Union High School District	\$875.45
C-20771-A	Mountainscapes Inc.	\$833.36
C-20772-A	ACLS	\$2,386.35
C-20773-A	City of McFarland	\$105.52
C-20775-A	City of Waterford	\$425.06
C-20776-A	City of Livingston	\$358.64
C-20808-A	Century Landscape, Inc.	\$1,552.15
C-20809-A	Burton School District	\$1,000.00
C-20852-A	Atwater Elementary School District	\$959.93
C-20853-A	Kern High School District	\$602.37
C-20854-A	Rosedale Union School District	\$935.87
C-20855-A	California State University, Fresno	\$971.61
C-20856-A	Hanford Elementary School District	\$801.30
C-20857-A	City of Porterville	\$873.78
C-20894-A	Valley Crest Landscape Maintenance Inc.	\$504.32
C-20895-A	Merced Union High School District	\$1,000.00
C-20896-A	Evergreen Landscape Service	\$1,559.94
C-20897-A	West Park Elementary School District	\$100.84
C-20899-A	Malaga County Water District	\$445.52
C-20900-A	San Joaquin County Parks and Recreation	\$959.53
C-20901-A	City Of Gustine	\$471.47
C-20902-A	McFarland Unified School District	\$911.07
C-20904-A	Fresno Unified School District	\$990.04
C-20905-A	Tulare City School District	\$924.82
C-20906-A	Lindsay Unified School District	\$1,000.00
C-20907-A	County of Kings	\$990.30
C-20908-A	Grover Landscape Services, Inc.	\$1,641.61
C-20910-A	Manteca Unified School District	\$974.60
C-20920-A	Lakeside Union School District	\$301.98
C-20921-A	Kings Canyon Unified School District	\$741.49
C-20922-A	California Department of Forestry and Fire Protection	\$504.20
C-20923-A	Fresno County Fire Protection District	\$705.88
C-20966-A	County of Stanislaus	\$78.40
C-21012-A	City of Modesto	\$986.90
C-21013-A	Clovis Unified School District	\$1,540.34
C-21020-A	City of Lemoore	\$1,000.00
C-21033-A	Earlimart School District	\$992.57
Total		\$60,617.27

Appendix C

Detailed results

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