



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT



Final Report

FARMER New Technology Demonstration Program

Zimeno Inc. DBA Monarch Tractor

20FD05

October 31, 2024



MONARCH®

Executive Summary

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Program Background

This project was funded through the Zero-emission mobile agricultural equipment demonstration program administered by the Bay Area Air Quality Management District (BAAQMD or Air District) and funded by the California Air Resources Board (CARB) using Funding Agricultural Replacement Measures for Emission Reductions (FARMER) Program funds from California Climate Investments (CCI).

Bay Area Air Quality Management District

The Air District is the public agency entrusted with regulating stationary sources of air pollution in the nine counties that surround the San Francisco Bay: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma counties. The California State Legislature created the Air District in 1955 as the first regional air pollution control agency in the country, recognizing that air pollution transcends political boundaries. The nine counties of the Bay Area form a regional air basin, sharing common geographical features and weather patterns, and therefore similar air pollution burdens, which cannot be addressed by counties acting on their own, www.baaqmd.gov.

California Air Resources Board

CARB is charged with protecting the public from the harmful effects of air pollution and developing programs and actions to fight climate change. From requirements for clean cars and fuels to adopting innovative solutions to reduce greenhouse gas emissions, California has pioneered a range of effective approaches that have set the standard for effective air and climate programs for the nation, and the world. CARB's mission is to promote and protect public health, welfare, and ecological resources through effective reduction of air pollutants while recognizing and considering effects on the economy. CARB is the lead agency for climate change programs and oversees all air pollution control efforts in California to attain and maintain health-based air quality standards, www.arb.ca.gov.

Solicitation Information

The project solicitation was released on March 6, 2020, and applications were due on April 25, 2020. The Air District's project solicitation offered up to \$1 million for projects that demonstrate mobile, zero-emission equipment in Bay Area agricultural operations and achieve significant reductions in greenhouse gas emissions, criteria pollutants, and toxic emissions. Funding of up to 75% of the eligible project costs was available for equipment that remained in operation for at least one year after completion of the demonstration period from June 1, 2021, to June 1, 2022, and the equipment was returned to the manufacturer. An additional funding of

5%, for a maximum funding level of 80% of the eligible project costs, was available for equipment that remained in operation for at least one year after the completion of the demonstration period which would total two years of operation. Monarch Tractor chose to operate the equipment for two years with the additional year of operation completed by June 1, 2023. After completion of the project term, all demo units were returned to Monarch for ongoing testing and development and replaced with production model MK-V Tractors.

On June 30, 2020, Monarch Tractor was awarded \$480,000 in grant funding for a two-year project life toward the demonstration of three zero-emission agricultural tractors and supporting infrastructure located at Wente Vineyards [5565 Tesla Road, Livermore CA 94550] and Crocker Estate [700 Dowdell Lane, St. Helena CA, 94574]. The program schedule required grant contracts to be executed by June 30, 2020, and field deployment of equipment to be completed no later than June 1, 2021.

Key delivery and completion dates:

- May 25, 2021: Unit PS 1053 was delivered to Wente Vineyards.
- May 27, 2021: Unit PS 1054 was delivered to Crocker Estate.
- May 28, 2021: Unit PS 1055 was delivered to Wente Vineyards.
- May 31, 2021: All three tractors were put into service.
- June 1, 2022: First year of tractor operation completed.
- June 1, 2023: Two years of operation completed.

Project Information

Monarch Tractor's demonstration featured the deployment of three fully electric Monarch Tractor Pilot units and associated charging infrastructure at two separate locations, with the goal of showcasing the technical and business viability of its zero-emission equipment as a "no compromise" alternative to diesel tractors.

The Monarch Tractor is a 40 horsepower (hp) compact tractor platform, combining battery-electric powertrain with driver optional and data capabilities. The units were deployed at two locations: Wente Vineyards, a commercial operation growing more than 2000 acres of premium sustainable wine grapes in Livermore, CA, and Crocker Estate, an 80-acre estate vineyard with 50 years of experience and commitment to responsible and sustainable farming techniques in St. Helena CA.

During the one-year test period, the three Monarch Pilot Series Tractors ran operations historically run by diesel tractors at Wente Vineyards and Crocker Estate. The Monarch Tractors were operated as part of the two vineyards' day-to-day operations, undertaking tasks such as mowing, herbicide spraying, fungicide spraying, and hauling fruit during harvest. The three tractors automatically collected operational data which was summarized and provided to BAAQMD in quarterly reports during the one-year program term. The Monarch tractors offset work historically completed by diesel tractors in the 40-80 hp range, depending on the

vineyard. The Monarch Tractor units utilized implements already owned by the two farms for use with their diesel tractors.

Over the course of the project, the three Monarch Tractor Units provided valuable insights to the Monarch Engineering teams. Deployments facilitated by BAAQMD funding provided everything from use case validation to data that supports that Monarch's electric tractors meet or exceed the capabilities of their diesel counterparts in these use cases. These tractors were the first out in the world beyond Monarch's test site and data and lessons from the operations they engaged in helped inform the design of the next generation of Monarch Tractors that are being used across California farms today.

Funding Source Acknowledgement

The FARMER Program is part of CCI, a statewide program that puts billions of Cap-and-Trade dollars to work reducing greenhouse gas emissions, strengthening the economy, and improving public health and the environment – particularly in disadvantage communities. The Cap-and-Trade program also creates a financial incentive for industries to invest in clean technologies and develop innovative ways to reduce pollution. CCI projects include affordable housing, renewable energy, public transportation, zero-emission vehicles, environmental restoration, more sustainable agriculture, recycling, and much more. At least 35 percent of these investments are located within and benefiting residents of disadvantaged communities, low-income communities, and low-income households across California. For more information, visit the CCI website: <http://www.caclimateinvestments.ca.gov/>.

FARMER Program

In 2017, CARB developed the FARMER Program to meet the legislature's objectives and help meet the State's criteria toxic and greenhouse gas emission reduction goals. The Air District has participated in the program since it was developed and administers FARMER program opportunities for the San Francisco Bay Area. In October 2019, CARB added additional project types to the FARMER program, including Advanced Technology Demonstration Projects <https://ww2.arb.ca.gov/our-work/programs/farmer-program>.

For a full copy of this report please reach out to the BAAQMD at grants@baaqmd.gov or 415-749-4994.