California Energy Commission

Clean Transportation Program

FINAL PROJECT REPORT

Eneridge Final Report for 150 kW Ultrafast Charger with Integrated-Battery Packs

Prepared for: California Energy Commission

Prepared by: Eneridge Inc.

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PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued GFO-20-605 to fund projects under the BESTFIT Innovative Charging Solutions program, which sought to demonstrate transformative technology solutions for large-scale deployment of innovative electric vehicle charging infrastructure. In response to GFO-20-605, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards April 16th, 2021 and the agreement was executed as ZVI-21-002 on 11/15/2021.

ABSTRACT

This report summarizes the work completed by Eneridge Inc. under the California Energy Commission (CEC) BESTFIT program for Agreement Number ZVI-21-002. Eneridge installed six battery-integrated direct current fast chargers (DCFCs), each rated at 150 kilowatts (kW), across three public sites in Southern California to demonstrate high-power charging with reduced grid impacts and minimized make-ready infrastructure requirements.

The project evaluated the operational performance of battery-integrated DC fast charging systems over a common 12-month period following commercial operation at all sites. Results showed that the chargers consistently delivered average peak charging power of approximately 89–104 kW per unit while limiting utility demand. At the Eastlake Village Center site, located in San Diego Gas & Electric (SDG&E) territory, measured demand remained within approximately 25–31 kW despite high-power charging, demonstrating effective demand charge mitigation through integrated battery buffering.

The project also identified operational considerations related to vendor continuity, following the charger manufacturer's bankruptcy in mid-2024. Despite the loss of original equipment manufacturer support, Eneridge maintained charger operation through third-party maintenance providers. Overall, the project demonstrated the technical feasibility and practical benefits of battery-integrated DC fast charging systems while highlighting key considerations for future deployments.

Keywords: Electric vehicles, battery-integrated charging, DC fast charging, demand charge mitigation, BESTFIT

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EXECUTIVE SUMMARY

High-power DCFCs are critical to supporting the continued growth of electric vehicle (EV) adoption, particularly in locations where grid capacity, installation costs, and utility demand charges present significant barriers. Battery-integrated DC fast charging systems offer a practical solution by enabling high-power charging while minimizing grid impacts, reducing make-ready infrastructure requirements, and avoiding costly demand charges. These systems can accelerate deployment timelines and expand access to fast charging in locations where traditional DCFC installations may be impractical or cost prohibitive.

Under the CEC BESTFIT program, Eneridge Inc. deployed six battery-integrated DC fast chargers, each rated at 150 kW, across three public sites in Southern California. The charging stations were installed at the following locations: Eastlake Village Center in Chula Vista, Trabuco Community Center in Irvine, and Garden Grove Plaza in Garden Grove. Each site was equipped with two chargers capable of serving both Combined Charging System (CCS) and CHAdeMO vehicles, expanding fast charging access for a wide range of EV drivers.

A key benefit demonstrated through this project was the reduced installation timeline enabled by the battery-integrated architecture. Because the chargers were able to operate using existing electrical infrastructure, none of the project sites required a new or upgraded utility service. Physical construction activities typically required approximately two to four weeks once permits were issued, with overall deployment timelines averaging approximately three months per site. In most cases, project schedules were driven primarily by permitting and inspection timelines rather than construction or utility coordination.

Operational performance was evaluated over a common 12-month period following the commencement of commercial operation at all sites. During this period, the chargers consistently delivered average peak charging power ranging from approximately 89 to 104 kW per unit, with average charging session durations of approximately 29 to 31 minutes. At the Eastlake Village Center site, which is located in SDG&E territory and subject to demand charges, two 150 kW chargers delivered high-power charging while measured utility demand remained within approximately 25 to 31 kW. This demonstrated the effectiveness of integrated battery systems in buffering grid demand and mitigating demand charges.

The project also encountered real-world operational challenges, most notably the bankruptcy of the charger manufacturer in mid-2024, which resulted in the loss of original equipment manufacturer service support. Despite these constraints, Eneridge maintained continued operation across all sites through third-party maintenance providers and field service efforts. This experience highlighted the importance of vendor continuity, service redundancy, and operational risk management when deploying emerging charging technologies.

Overall, this project demonstrated the technical feasibility and practical benefits of battery-integrated DC fast charging systems in reducing grid impacts, accelerating deployment, and enabling high-power charging in cost- and grid-constrained environments. The findings and lessons learned from this project can inform future BESTFIT and CEC-funded efforts aimed at expanding reliable and scalable EV charging infrastructure across California.

Chapter 1: Project Description

Purpose

This project demonstrated the technical and practical feasibility of deploying high-power, battery-integrated DC fast chargers as a means to reduce grid impacts, minimize make-ready infrastructure requirements, and mitigate utility demand charges and high on-peak energy charges while delivering reliable fast charging service. The project aimed to install and operate six battery-integrated DC fast chargers across three public sites in Southern California using existing electrical infrastructure.

The project originally proposed the use of 120 kW battery-integrated chargers. During project execution, the charger manufacturer transitioned its product line and discontinued the 120 kW units. As a result, Eneridge deployed 150 kW battery-integrated DC fast chargers, providing increased charging capability while maintaining the original project objectives and technical approach.

Approach

Eneridge identified publicly accessible sites with existing electrical infrastructure capable of supporting battery-integrated DC fast charging without requiring new or upgraded utility service. Site selection focused on locations where conventional DCFC installations would typically require extensive utility coordination, longer construction timelines, or exposure to high demand charges.

Eneridge executed site host agreements with property owners and retained ownership and operational responsibility for all installed charging equipment. Eneridge managed all aspects of project delivery, including engineering design, permitting, construction coordination, commissioning, and ongoing operations. Battery-integrated charging technology was intentionally selected to align with BESTFIT program goals related to grid impact reduction, deployment efficiency, and system scalability.

Activities Performed

Eneridge completed multiple activities to bring the charging stations from initial concept through installation, commissioning, and commercial operation in accordance with the Scope of Work for Agreement No. ZVI-21-002.

1. **Site Investigation and Feasibility**
    - Preliminary site assessments and field verification
    - Evaluation of existing electrical infrastructure to confirm suitability for battery-integrated DC fast charging
    - Development of preliminary site layouts to confirm charger placement and constructability
    - Preliminary constructability and cost feasibility assessment to support project implementation
2. **Design and Agreements**

- Preparation of site-specific electrical and civil design drawings
- Development of finalized installation scopes of work for each project location
- Execution of site host agreements defining site access, equipment placement, and operational responsibilities

3. **Permitting**
   - Preparation and submission of local planning and building permit applications
   - Coordination with local authorities having jurisdiction for plan review and approval
   - Incorporation of ADA-compliant parking, signage, and path-of-travel requirements
4. **Make-Ready and Site Preparation**
   - Trenching, conduit installation, concrete equipment pads, and electrical panel work
   - Installation of required signage, striping, bollards, and accessibility features
   - Restoration of disturbed site areas
5. **Charger Installation and Construction**
   - Delivery and placement of battery-integrated DC fast charging equipment
   - Electrical interconnection using existing utility service
   - Coordination of construction inspections and resolution of punch list items

Physical construction activities typically required approximately two to four weeks per site once permits were issued. Overall project timelines averaged approximately three months per site, with permitting and inspection processes representing the primary schedule drivers.

6. **System Testing and Commissioning**
   - Electrical safety checks and system performance testing in accordance with manufacturer specifications
   - Verification of battery-integrated charging system operation
   - Network connectivity and communications testing
   - Final municipal inspections and authorization for commercial operation
7. **Operations and Data Collection**
   - Commencement of commercial operation at all project sites
   - Ongoing monitoring of charger performance and availability
   - Collection of operational data over a 12-month period following full site operation
   - Coordination with third-party service providers for maintenance and repairs

Chapter 2: Results and Recommendations

Eneridge successfully installed and placed into commercial operation six battery-integrated DC fast chargers, each rated at 150 kW, across three sites:

- **Eastlake Village Center (Chula Vista):** 2 chargers
- **Trabuco Community Center (Irvine):** 2 chargers
- **Garden Grove Plaza (Garden Grove):** 2 chargers

During the 12-month reporting period from December 27, 2024 through December 26, 2025, the chargers demonstrated consistent performance. Average peak charging power ranged from approximately 89 to 104 kW per charger, with average charging session durations of approximately 29 to 31 minutes. Total energy dispensed during the reporting period exceeded 235,000 kWh across all locations.

At the Eastlake Village Center site, located within SDG&E territory and subject to demand charges, the battery-integrated chargers demonstrated significant grid buffering benefits. Despite operating two 150 kW chargers with average peak charging power of approximately 103 kW per unit, measured utility demand remained within approximately 25 to 31 kW.

Advancements in Science and Technology

This project provided real-world validation of battery-integrated DC fast charging as a practical deployment alternative to conventional high-power DCFC installations. The deployed systems demonstrated that integrated energy storage can effectively reduce grid impacts, avoid new utility service upgrades, and enable high-power charging in electrically constrained environments.

Project Success

Eneridge met the core objectives of the BESTFIT agreement by deploying and operating battery-integrated DC fast chargers that demonstrated reduced installation complexity, shortened construction timelines, and measurable demand charge mitigation. All chargers reached commercial operation, and Eneridge collected a full 12 months of operational data following completion of all sites.

Although the project encountered challenges related to the charger manufacturer's bankruptcy, Eneridge maintained continued operation through third-party service providers and internal operational support.

Observations

This project demonstrated that battery-integrated DC fast chargers can significantly reduce dependency on utility infrastructure compared to conventional DCFC deployments. Permitting and inspection timelines influenced project schedules more than construction or utility coordination.

The loss of manufacturer support highlighted the importance of vendor continuity, service redundancy, and contingency planning when deploying emerging charging technologies.

Conclusions

Eneridge appreciates the support provided by the California Energy Commission in enabling the successful deployment and evaluation of innovative battery-integrated DC fast charging technology. This project demonstrated that such systems can reduce grid impacts, lower make-ready requirements, and mitigate demand charges while delivering high-power charging to EV drivers.

Recommendations

For future projects, Eneridge recommends incorporating enhanced service contingency planning, diversified maintenance strategies, and continued evaluation of battery-integrated charging systems across different utility territories and rate structures. These steps will support scalable, resilient, and cost-effective deployment of advanced EV charging infrastructure.

Chapter 3: Data Collection and Analysis

One-Time Data

Eneridge compiled the following one-time project data to the extent it was available for Agreement No. ZVI-21-002:

- **Number and type of chargers installed:**
  Six (6) battery-integrated direct current fast chargers (DCFCs)
- **Location and installation sites:**
  - **Eastlake Village Center**, Chula Vista (2 chargers)
  - **Trabuco Community Center**, Irvine (2 chargers)
  - **Garden Grove Plaza**, Garden Grove (2 chargers)
- **Nameplate capacity of installed equipment:**
  150 kW per charger
- **Number and type of outlets per charger:**
  - CCS and CHAdeMO connectors
- **Location type:**
  Publicly accessible commercial and community-serving locations
- **Project cost and funding sources:**
  - **Total project cost:** $1,363,492
  - **CEC BESTFIT funding:** $1,000,000
  - **Eneridge cost share (match):** $363,492

Twelve Months of Operational Data

Eneridge compiled operational data for a common 12-month period from **December 27, 2024 through December 26, 2025**, following the commencement of commercial operation at all project sites.

- **Total charging sessions:** 7,605 sessions
- **Average peak charging power delivered:** Approximately 89–104 kW per charger
- **Average charging session duration:** Approximately 29–31 minutes
- **Total energy dispensed:** Over 235,000 kWh across all sites

Uptime

Charger uptime during the reporting period varied by site and reflected differences in commissioning timing and operational conditions:

- **Eastlake Village Center:** 78.40%
- **Trabuco Community Center:** 88.86%

- **Garden Grove Plaza:** 88.14%

Demand Charge and Grid Impact

Eneridge reviewed monthly maximum utility demand for each project site. Each site operates two 150 kW battery-integrated DC fast chargers served by a single utility meter. Despite the high nameplate capacity of the charging equipment, observed site-level monthly peak demand remained significantly lower due to the integrated battery systems.

Average monthly maximum demand during the reporting period was approximately:

- **25.1 kW** at Eastlake Village Center
- **37.2 kW** at Trabuco Community Center
- **37.5 kW** at Garden Grove Plaza

Across the three sites, the **average of site-level monthly maximum demand was approximately 33 kW**. These results demonstrate the effectiveness of battery-integrated charging systems in buffering high-power charging events and limiting grid demand. Notably, Eastlake Village Center is located within SDG&E territory and is subject to demand charges; however, demand exposure was significantly reduced relative to conventional DC fast charging installations.

Greenhouse Gas Emissions

Greenhouse gas emissions reductions were estimated based on observed electricity dispensed and standard vehicle displacement assumptions. During the 12-month reporting period, the charging stations dispensed approximately **235,000 kWh** of electricity. Using a conservative average electric vehicle efficiency of **0.30 kWh per mile** and an average gasoline vehicle emissions factor of **404 grams of CO_2 per mile**, the project is estimated to have displaced approximately **316 metric tons of CO_2e** over the reporting period. These estimates are intended to provide an order-of-magnitude indication of emissions benefits.

Renewable Energy

There was no onsite renewable energy generation associated with the project sites. Eneridge did not procure renewable energy certificates specifically for this project.

Economic Development

This project supported multiple engineering, electrical, and construction subcontractors during the design and installation phases. In addition, ongoing charger operation and maintenance activities continue to support technical and field service work. The project sites are located at commercial and community-serving locations where EV drivers may patronize nearby businesses while charging.

Proposal vs. Actual Comparison

The original project proposal included deployment of 120 kW battery-integrated DC fast chargers. During project execution, the charger manufacturer discontinued the 120 kW units and transitioned to 150 kW battery-integrated chargers. The deployed equipment provided higher charging capability while maintaining the original project objectives related to grid impact mitigation, make-ready reduction, and deployment efficiency.

GLOSSARY

BATTERY ELECTRIC VEHICLE (BEV)—Also known as an "All-electric" vehicle (AEV), BEVs utilize energy that is stored in rechargeable battery packs. BEVs sustain their power through the batteries and therefore must be plugged into an external electricity source in order to recharge.

Combined Charging System (CCS) — A standardized charging connector and protocol for electric vehicles that supports both AC Level 2 charging and DC fast charging through a single inlet.

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

1. Forecasting future statewide energy needs
2. Licensing power plants sufficient to meet those needs
3. Promoting energy conservation and efficiency measures
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
5. Planning for and directing state response to energy emergencies.

DIRECT CURRENT (DC)—A charge of electricity that flows in one direction and is the type of power that comes from a battery.

KILOWATT (kW) — A unit of power equal to 1,000 watts, commonly used to describe the instantaneous power output or demand of electrical equipment.

KILOWATT-HOUR (kWh) — A unit of energy representing the consumption of one kilowatt of power over the course of one hour, commonly used to measure electricity consumption or delivery.

San Diego Gas & Electric (SDG&E) — A regulated electric and natural gas utility that provides service to San Diego County and portions of southern Orange County, California.