



Off-Grid DC Fast-Charing Snapshot

Examples of Off-Grid Charging Solutions for the Intermountain West

UTAH CLEAN CITIES

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Introduction

State Energy Offices, State Departments of Transportation, and State Environment Agencies in the Intermountain West have worked in partnership through the REV West Memorandum of Understanding to electrify transportation corridors and support electric vehicle (EV) charging infrastructure buildout. While the REV West states have already deployed over 175 direct current fast-charging (DCFC) stations in the region, and is now working with Clean Cities Coalitions, utilities, and other private sector partners to support further EV infrastructure buildout, challenges remain to complete charging corridors – particularly in rural and remote areas.

The unique geography of the Intermountain West makes it particularly expensive to deploy high-speed electric infrastructure with the ability to provide three-phase power at remote and low-use DCFC stations around the region. Throughout much of the region, there are dozens if not hundreds of highway miles with limited transmission and distribution infrastructure, resulting in very few places to safely charge. Delivering power to these remote areas could require expensive transmission expansion, and even in areas with power, it is often uneconomical for station hosts to provide fast-charging.

To address this, states are looking at ways to leverage distributed energy technologies to provide fast-charging services with lower investment costs than new transmission lines. Below are several current case studies or product options available to states and their partners as they work to increase DCFC infrastructure and support range confidence for EV drivers in rural and remote areas. While this list is not exhaustive, it will provide a snapshot of the technologies and initiatives currently available.

Trade-Offs for Investment Costs

"Grid-edge" and off-grid technologies have the potential to provide significant cost savings in areas where transmission and distribution upgrades are prohibitively expensive. A recent report by the Colorado Energy Office, "Feasibility Study of DCFC + BESS in Colorado" examines trade-offs in DCFC installations between extending power lines and integrating Battery Energy Storage Systems (BESS) into charging stations.[1] This report reviews current market prices for DCFC equipment and related infrastructure, both for transmission expansion and BESS stations.

Without on-site generation or storage, a DCFC station requires three-phase power lines and a 480-volt(V) transformer. The Colorado report examined the cost of extending this infrastructure to new charging stations, and while prices vary greatly by the specific geography and existing infrastructure, the report identified cost estimate ranges from other states and electric service territories. In California, PG&E estimates that a new 480V transformer with an additional 100

[1] E9 Insight and Optony, Inc. "Feasibility Study of DCFC + BESS in Colorado: A technical, economic, and environmental review of integrating battery energy storage systems with DC fast charging." April 2022. Prepared on behalf of the Colorado Energy Office.

feet of transmission line for grid connection can cost around $58,000.[2] Additionally, PG&E estimates that new 15kV service extensions could cost $47.7 per foot, or approximately $252,000 per mile of additional lines. However, these estimates can vary widely: Kansas Rural Electric Cooperatives estimates it will cost approximately $45,000 per mile of new three-phase power lines. Lastly, these costs increase exponentially as DCFC station power levels increase. In Ottawa Ontario, "increasing the capacity of DCFC from 150 kW to 400 kW increased overall project costs by approximately 400-600% compared to only marginal cost increases from 50 kW to 100 kW systems, and 100 kW to 150 kW systems."[3]

In addition to paying infrastructure costs, electric bills for high-speed three-phase power can make it hard for station owners to turn a profit. In a rates analysis for the Intermountain West region, NASEO found that the price of DCFC charging can reach around $3/kWh,[4] in comparison to average regional electric prices of $0.10/kWh.[5] While exact costs for electric infrastructure and service will vary by location, these present very real costs for DCFC developers.

The rest of this Snapshot will feature case studies and product options which enable DCFC charging in grid-edge or off-grid environments, which could present cost-effective alternatives to extending three-phase power lines.

Grid-Edge Stations

Renewable Generation at Stations
Standalone generation at EV charging stations may offer a more cost-effective solution for power delivery at certain stations, as well as support climate and air quality goals by providing low-carbon electricity to power EVs. With variable generation (e.g., via solar canopies) these stations would require grid connection to provide reliable fast-charging.

Several companies offer charging stations with solar canopies attached, wind turbines, or more custom options to meet specific station needs. Below are a few examples, although there are other companies and government-led initiatives across the country:

- iSun has won competitive solicitations to provide solar canopies for EV charging;
- Sayna Skypump offers EV charging powered by a vertical wind turbine;
- Off-Grid Installer offers customized solar charging solutions for several station types;

Storage at Stations
Standalone battery systems can be helpful even without on-site generation. Such DCFC stations would require a grid connection, but can help provide fast charging speeds on low-voltage distribution lines or help station owners regulate prices by balancing out large increases in

[2] *Id.* Page 44.
[3] *Id.* Page 44.
[4] National Association of State Energy Officials. "*Demand Charges & Electric Vehicle Fast-Charging: An Intermountain West Assessment*." October 2021. Page 14.
[5] *Id.* Pages 18-19.

power demand from charging vehicles. At the end of 2021, Electrify America had installed 140 DCFC stations around the country with more than 30 MW of storage capacity, in order to drive down costs for their network.

FreeWire's Boost Charger is one product option. By integrating batteries into their charger, FreeWire is able to take low power levels (up to 27 kW), and then provide charging speeds equivalent to 150kW fast-charging. The minimized electric infrastructure also means that Boost Chargers can be relocated much more easily than traditional DCFC stations. However, the low power intake may result in the charger being offline for the batter to recharge during sessions.

Off-Grid Stations

Renewable Generation + Battery Storage
On-site generation can be paired with energy storage to achieve off-grid charging. Combining these technologies allows on-site electricity generation to be stored and deployed for fast charging as needed. As with other battery powered systems, there may be some down time required between charges to replenish batteries. Many companies currently offer off-grid fast charging stations. Some examples include:

- Potomac Edison will be working with the Maryland Energy Administration through their Solar Canopy Program to deploy a pilot solar-powered DCFC station. The installation is expected to cost around $1.1 million with another $1 million in O&M over a 15-year time period. The station will include solar generation with a 500 kW/1 MWh battery system capable of charging vehicles at speeds of 125 kW.
- EV4Oregon has deployed several of their ETM solar powered charging systems in the state. Most projects have been tied to the grid with single phase power, with 15 solar modules and the ability to charge a standard EV in 25 minutes;
- Beam's EV ARC system offers a fully off-grid, portable charging station, with a 4.3 kW solar canopy integrated. Currently these are Level 2 charging stations, but Beam is working with charging companies to integrate their product with fast-chargers.

Hydrogen-Powered Stations
Hydrogen offers an alternative to battery storage and is starting to be leveraged to provide fast-charging services in remote areas. In early 2021, Renewable Innovations struck a partnership with GM to develop portable fast charging stations using GM's HYDROTEC fuel cells. Without on-site generation, these stations will be able to power around 100 fast-charges before they will require hydrogen refueling.

Microgrids
Depending on the scale of the EV charging needs, microgrids are an effective option as well. In late 2021, Florida Power and Light announced a pilot project to build a solar-powered microgrid with the ability to charge up to twelve vehicles at once. The isolated microgrid will store solar generation with a 7.5MW/15MWh battery system. Then two mobile trailers will be converted into fast charging stations, each with a smaller battery system (650kW/1.3MWh) and six fast-charging ports.

Final Considerations

The technologies outlined above can help state governments and other stakeholders install fast charging even in remote regions. Through the National Electric Vehicle Infrastructure Formula Program, states are required to deploy 600 kW charging infrastructure every 50 miles along interstate corridors. The goal is to create a seamless and simple consumer experience for EV charging all around the country and provide range confidence for drivers. This marks a significant increase in the power requirements at remote fast charging stations. For comparison, the REV West Voluntary Minimum Standards include a minimum power threshold of 50 kW with a stretch goal of 150 kW. As noted by the Colorado study above, these power thresholds will increase station costs exponentially, providing a significant challenge, most acute in rural and remote areas with less demand for charging services and less existing electrical capacity. As the EV market matures with more electric cars on the road with longer ranges and higher battery capacities, the demand for higher power charging will continue to grow.