Charging Forward: Revitalizing Brownfield Sites into Electric Vehicle Charging Stations

As more electric vehicles (EVs) enter roadways every year, a broader charging infrastructure network is needed to fuel these vehicles. Cleaning up and transforming underused and potentially contaminated properties into EV charging stations is a strategic way to meet this demand. This fact sheet details benefits and considerations for redeveloping brownfields into charging stations.

Benefits of Converting Brownfields to EV charging stations:

Environmental

- Restores contaminated land to beneficial reuse.
- Aligns with local and state climate change goals by decreasing greenhouse gas emissions, air pollution, and dependency on fossil fuels.
- Expands access for communities to EV charging infrastructure.
- Battery storage capabilities can increase community resilience during power outages.
- Groundwater treatment (if part of ongoing cleanup actions) can proceed concurrently with station operations with oversight agency approval.

Economic

- Redevelopment of key properties close to multi-unit dwellings and freeways can be profitable.
- Property cleanup costs can be less expensive compared to other redevelopment options.
- Public grant opportunities exist to offset property cleanup and construction costs.
- Cleaning up contaminated sites increases the value of the neighboring properties.
- EV charging customers patronize adjacent retail as they wait for charging, supporting local economies.

Types of Electric Vehicle Charging

Level 1 Charging	Level 2 Charging	Direct Current Fast Charging (DCFC)
2 to 5 miles of range per 1 hour of charging	10 to 20 miles of range per 1 hour of charging	180 to 240 miles of range per 1 hour of charging

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Considerations when selecting a potential brownfields site

Favorable Physical Site Characteristics

- Community surrounding the site supports EV charging as site reuse.
- Short distance to highways and off-ramps.
- Located along major travel corridors for consumer and fleet travel.
- Accessible to the street.
- Site size can support charging infrastructure, including any Americans with Disabilities Act requirements.
- Availability of a wired or wireless internet connection or cellular service, particularly if customers will pay for use of the charging station.
- Nearby retail amenities.
- Nearby multi-unit housing or a high density of potential customers.
- Current zoning of the site supports EV charging.
- Site is publicly owned.
- If privately owned, owner interested in EV charging as site reuse.

Environmental Considerations

- Is a current environmental assessment available?
- Is site cleanup necessary?
- What are the regulatory cleanup requirements?
- Are there environmental enforcement activities on the site?

Electrical Capacity Considerations

- Is there sufficient electrical load hosting capacity based on EV charging analysis?
- Does the existing on-site electrical equipment and infrastructure support a potential EV station?
- What is the distributed energy resource (DER) hosting capacity?

TIPS

- **Determine the market demand before investigating sites.**
- **Visit DOE's Alternative Fueling Station Locator to determine if other DCFC stations exist in your area.**
- **Analyze multiple potential EV sites simultaneously to cut down on assessment costs per site.**

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Evaluating the Economic Feasibility

While there are several costs that must be considered when redeveloping brownfield sites, the revenue generated from EV charging stations in addition to potential public incentives can offset the costs and make a charging station an economically viable reuse option.

COSTS: Inputs/Assumptions

- Environmental cleanup costs
- Station utilization[1]
- Load profile[2]
- Hardware capital expenditure
- Installation capital expenditure
- Grid infrastructure capital expenditure[3]
- Electricity cost
- Battery storage capital expenditure
- Battery storage operation and maintenance (O&M)
- Charger maintenance
- Charger networking fees[4]
- Solar Photovoltaics (PV) capital expenditure
- Solar PV O&M
- Battery charge cost

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REVENUE: Inputs/Assumptions

- Electricity pricing
- Local incentives
- State incentives
  - US Department of Energy's Incentives
- Federal incentives
  - Alternative Fuel Infrastructure Tax Credit

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Outputs:
Net Annual Cost and Revenues

[1] Station Utilization: The time when chargers are in use divided by the total time period
[2] Load profile: Variation in station power used over time
[3] Grid Infrastructure: Type and size of upstream equipment along with existing loading levels
[4] Charger Networking fees: Depending on the network provider

EPA's Brownfields Program provides grants and technical assistance to communities, states, tribes and others to assess, safely clean up and sustainably reuse contaminated properties. To learn about EPA's broader efforts to put previously contaminated properties back into productive use, read about our Land Revitalization Program.

Owners of EV charging stations may generate revenue in the following ways:

1. Billing a fee by the minute or hour of usage.
2. Billing a per-session fee.
3. Charging a fee per kilowatt-hour ($/kWh).
4. Billing "overstay" fees for drivers who continue to park after the vehicle is finished charging.

Key cost considerations:

- Hardware costs, including the charger and its pedestal, can vary widely based on the charger's power and its capability to collect payments.
- Charger installation costs typically include labor, materials (e.g., wiring), permits, and taxes.
- The cost and complexity of establishing new electric service to the EV charging sites depends on the capacity of existing grid infrastructure close to each site.
- Level 1, Level 2, and DCFC installation costs need to be evaluated for each installation based on charging time requirements for anticipated users (e.g. overnight for multi-family dwelling residents vs. expedited charging for delivery vehicles throughout a work day), potential transformer upgrades, volume of users, etc.

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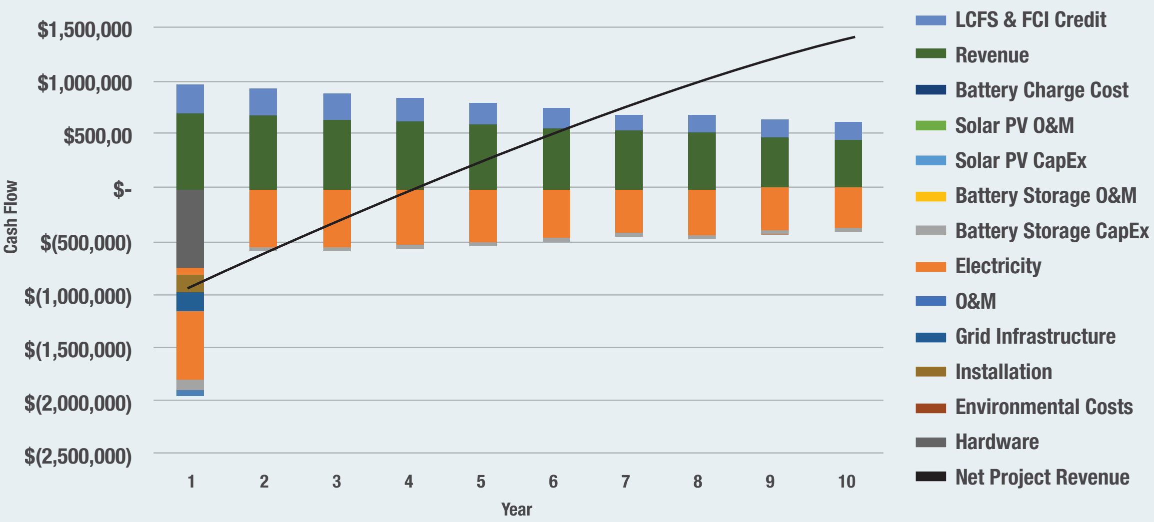
Example: Economic Feasibility of a Proposed Light Duty DC Fast Charging Station* in California over a 10-year Timeframe under Best, Moderate, and Worst Case Cost/Revenue Assumptions

Scenario		10 Year Cost and Benefit - Best	10 Year Cost and Benefit - Moderate	10 Year Cost and Benefit - Worst
Scenario 1: Baseline (DCFC only)	Total Cost	$6,258,460	$5,334,660	$3,276,619
	Total Revenue	$10,400,093	$6,037,836	$1,620,941
	Net Project Benefit	$4,141,632	$703,177	-$1,655,678
Scenario 2: Baseline + Solar PV	Total Cost	$6,261,292	$5,334,744	$3,274,413
	Total Revenue	$10,401,576	$6,038,908	$1,622,812
	Net Project Benefit	$4,140,284	$704,164	-$1,651,601
Scenario 3: Baseline + Battery Energy Storage + Solar PV	Total Cost	$6,421,840	$5,476,997	$3,487,333
	Total Revenue	$10,401,576	$6,038,908	$1,622,812
	Net Project Benefit	$3,979,736	$561,911	-$1,864,521
Scenario 4: Baseline + Time-dependent pricing	Total Cost	$5,741,558	$4,944,214	$3,220,990
	Total Revenue	$10,633,599	$6,198,202	$1,641,994
	Net Project Benefit	$4,892,041	$1,253,988	-$1,578,995

**The proposed DCFC station was a 0.25-acre site that would support 10 chargers in a high-traffic urban area*

FINANCIAL PRO FORMA MODEL:



LCFS: Low Carbon Fuel Standard
FCI: Fast Charging Infrastructure
CapEx: Capital Expenditure

Example:
A pro forma model of a proposed light duty charging station at a brownfield site in California over a 10-year timeframe determined that the site would be financially viable.

TIPS

- **The installation cost per charger decreases as the number of chargers increases. Read Rocky Mountain Institute's report to learn about other opportunities for decreasing infrastructure costs, and the Department of Energy's report to learn more about infrastructure cost drivers.**
- **Reach out to the local electric utility to identify electrical infrastructure considerations and local Clean Cities coalitions for opportunities.**

CO-LOCATING SOLAR AND BATTERY STORAGE

Incorporating Distributed Energy Resource (DER) technologies, such as solar and battery storage, can reduce electricity costs by providing energy (kWh) and capacity (kW) for the EV station. DER technologies can also provide back-up power for the surrounding community during a grid outage. Pairing solar and battery energy storage is particularly compelling given that solar generation can offset the cost of energy needed to charge vehicles during the day and on-site batteries can be used to charge vehicles at a lower cost during peak periods when electricity from the grid costs more.

Battery Energy Storage: Battery storage devices are flexible assets that can deliver significant financial benefits under the right conditions (e.g., tariff rate structures, customer site demand, etc.). Including battery energy storage may allow EV charging stations to be located where distribution line capacity is limited, as the batteries can charge from the grid during off-peak usage times, such as the middle of the night. This means it may be possible to install an EV charging station without upgrading utility distribution lines.

Use cases for this include:

1. Time-of-use bill management
2. Demand charge management
3. EV charging during a grid outage

Solar Photovoltaics: Pairing solar production with battery storage can be used to further offset the cost of EV charging and to create additional value streams for the site owner. Additionally, installing solar would reduce the carbon footprint of charging. Site infrastructure like canopies or rooftops can be utilized for rooftop solar to maximize efficiency and increase comfort for customers and employees.

TIPS

- **Plan for blackouts. Coupling battery energy storage with solar PV increases the resilience of the site and provides a critical community benefit during outages.**
- **The National Renewable Energy Laboratory's (NREL) PVWatts® Calculator estimates the energy production and costs of energy of grid-connected PV energy systems.**

CASE STUDIES

CASE STUDIES

- East Bay Community Energy financial analysis TA: In 2021, EPA provided contractor technical assistance (TA) to a not-for-profit public agency that determined the environmental and economic feasibility of redeveloping two brownfield sites in California into flagship fast charging stations.
- Takoma Park, MD: This gas station was converted into an EV charging station that opened in 2019.

READY TO GET STARTED? HOW EPA RESOURCES CAN HELP:

$ EPA Brownfields Technical Assistance (TA)

$ EPA Brownfields Assessment Grants

$ EPA Brownfields Cleanup Grants

Identify possible brownfield sites based on the considerations from page 2 → Analyze costs and benefits of development → Conduct environmental assessments → Clean up site, if needed → Plan and construct charging station

RESOURCES

- US EPA Brownfield Grant Funding: https://www.epa.gov/brownfields/types-epa-brownfield-grant-funding
- Plug In America, EV Supply Equipment Costs: https://pluginamerica.org/get-equipped/
- US DOE, Electric Vehicle Information: https://www.energy.gov/science-innovation/vehicles
- US DOE, Alternative Fuels Data Center, Federal and State Laws and Incentives: https://afdc.energy.gov/laws/
- US DOE, Alternative Fuels Data Center, Electric Vehicle Charging Stations: https://afdc.energy.gov/fuels/electricity_stations.html
- US DOE, Costs Associated With Non-Residential Electric Vehicle Supply Equipment: https://afdc.energy.gov/files/u/publication/evse_cost_report_2015.pdf
- US NREL, Guide for Identifying and Converting High-Potential Petroleum Brownfield Sites to Alternative Fuel Stations: https://www.nrel.gov/docs/fy11osti/50898.pdf
- US NREL, PV Watts® Calculator: https://pvwatts.nrel.gov/index.php
- RMI, Reducing EV Charging Infrastructure Costs: https://rmi.org/wp-content/uploads/2020/01/RMI-EV-Charging-Infrastructure-Costs.pdf

Learn more about brownfields redevelopment at https://www.epa.gov/brownfields

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