

Bridging the Gap: Making Bidirectional Charging Accessible to Underserved Communities

Introduction

As Illinois moves toward a cleaner energy future, ComEd is exploring innovative solutions like bidirectional charging to support the [state's goal of 1 million electric vehicle \(EV\) registrations by 2030](#). Bidirectional charging allows EVs to not only draw power from the grid but also send energy back to homes, buildings or the grid itself. This two-way energy flow may help improve grid reliability, reduce energy costs and lower emissions—benefiting both customers and communities.

As implementation of the [Beneficial Electrification Plan](#) progresses, ComEd continues to evaluate how to best deliver benefits to all customers, especially the geographic areas throughout Illinois that would most benefit from equitable investments by the state designed to combat discrimination and foster sustainable economic growth. These communities are inclusive of [low-income](#) (LI) households;¹ [Restore, Reinvest, Renew](#) (R3) communities;² and [environmental justice](#) (E) communities,³ jointly referred to as “Select Customers.”⁴

To further this commitment, ComEd launched a comprehensive Bidirectional Charging Environmental and Social Impact Study to evaluate how bidirectional charging technology can deliver tangible benefits to Illinois communities. This study goes beyond general impact assessment by applying a targeted methodology to map environmental and social benefits for Select Customers. By evaluating local-level impacts and prioritizing equity, the study aims to provide actionable insights that guide investments and program design, ensuring that the advantages of bidirectional charging are accessible to those who stand to benefit most.

Existing Disparities in Clean Energy and EV Charging Access

While the transition to EVs and clean energy is accelerating, research consistently shows that access to these benefits is not distributed equally. Studies have found that lower-income households, communities of color and residents of multi-family or rental housing often face significant barriers to both public and residential EV charging.

- **Income and race:** The Center for Global Sustainability's analysis on income and racial disparities in EV infrastructure accessibility highlights that public EV charging infrastructure is disproportionately located in higher-income and predominantly white neighborhoods, leaving “charging deserts” in many low-income and minority communities.⁵

- **Housing type:** SEPA's research on [Disparities in Residential Charging Access](#) shows that renters and residents of multi-family buildings have far fewer options for at-home charging compared to single-family homeowners. These challenges can stem from factors such as limited control over property modifications, lack of dedicated parking spaces and higher installation costs for shared infrastructure. As a result, these households are far more reliant on public or workplace charging, which can increase costs and reduce convenience.
- **Geography:** Regional disparities in public EV charging access persist across the United States. Rural communities and certain urban neighborhoods often have far fewer charging stations compared to wealthier or more densely populated areas, creating “charging deserts” that limit adoption and access. Recent research from [UCLA](#) highlights that disadvantaged regions may have up to 64% fewer public chargers per capita than affluent areas, with pronounced gaps in both infrastructure and investment.⁶
- **Community-level barriers:** The Kern Region EV Charging Station Blueprint Project⁷ and the California Energy Commission/Union of Concerned Scientists Equity Workgroup Report⁸ identify affordability challenges, limited infrastructure and lack of community engagement as persistent obstacles in disadvantaged communities.

National research and guidance emphasize that closing these gaps requires more than just technical solutions. Leading national organizations such as Pacific Northwest National Laboratory (PNNL),^{9,10} National Renewable Energy Laboratory (NREL)¹¹ and Lawrence Berkeley National Laboratory (LBNL)¹² have published reports on embedding equity considerations into EV charging efforts. For example, PNNL's research highlights the importance of measuring who has access and listening to community needs as well as developing ways to track progress on resilience and equity; NREL provides federal guidance for investing in areas that need it most and using equity planning tools; and LBNL shares practical tips for reaching out to underserved communities and making programs transparent. Applying these approaches can help ensure that clean energy and EV charging reach the people and places that need them most, creating a more inclusive and accessible clean energy future for all communities.

Assessing Equity and Community-Level Benefits: Our Approach

To understand how bidirectional charging can advance equity and sustainability, the ComEd Bidirectional Charging Environment and Social Impact Study uses a two-part approach:

1. Environmental Analysis: Prospective Life Cycle Assessment (pLCA)

The study quantifies greenhouse gas (GHG) emissions and air pollutant impacts (NO_x, SO₂, PM_{2.5}) of bidirectional charging and related technologies – V2X¹³, V2G, V2H, V2B, stationary battery energy storage systems (BESS) and managed charging—under various decarbonization scenarios.

How it works: The study models hourly grid emission factors using NREL's [Cambium](#) dataset, calibrated with EPA's [eGRID](#) data and system electricity demand.

The focus: This analysis examines the “use-phase” of bidirectional charging technology, which refers to when the systems are actively operating. It encompasses aspects such as charging and discharging cycles, inverter losses, battery degradation and round-trip efficiency.

Scenarios: The study evaluates three grid decarbonization pathways—Base, Optimistic and Pessimistic—to ensure recommendations are robust across a range of possible futures. The Base scenario follows current plans, the Optimistic scenario assumes faster progress and the Pessimistic scenario assumes slower improvement. Results are presented in five-year increments from 2025–2040 to capture system-level trends.

2. Social and Equity Analysis: Multi-Criteria Decision Analysis (MCDA)

The study quantifies and combines environmental data with social and equity factors using a spatial MCDA approach. This helps identify communities that could benefit most from bidirectional charging.

Mapped data layers: ZIP codes within ComEd’s service territory, peaker plant locations across Illinois and the geographic and socioeconomic profiles of LI, EJ and R3 communities

Weighting priorities: The study used an Analytical Hierarchical Process¹⁴ to assign weights to key criteria aligned with the research objectives. Criteria options were compared two at a time and a rating scale was used to identify which factors matter most. The rating scales helped assign numerical weights that show the relative importance of each factor in the final decision.

Ranking: The above weighted factors were then applied through the TOPSIS (Technique for Order of Preference by Similarity to Ideal Solution) method—an MCDA technique that ranks alternatives based on their proximity to an “ideal” solution. Communities were evaluated based on proximity to peaker plants; energy burden; designation as LI, EJ or R3 communities; and infrastructure readiness indicated by EV registration levels.

Figure 1 illustrates several key data layers incorporated into the study’s spatial analysis. These include publicly available maps of EJ and R3 communities,¹⁵ as defined under the Climate and Equitable Jobs Act¹⁶, along with emissions information from Illinois peaker plants.¹⁷ These inputs provide the foundational geographic and environmental context used in the MCDA to understand areas with overlapping environmental and equity considerations.

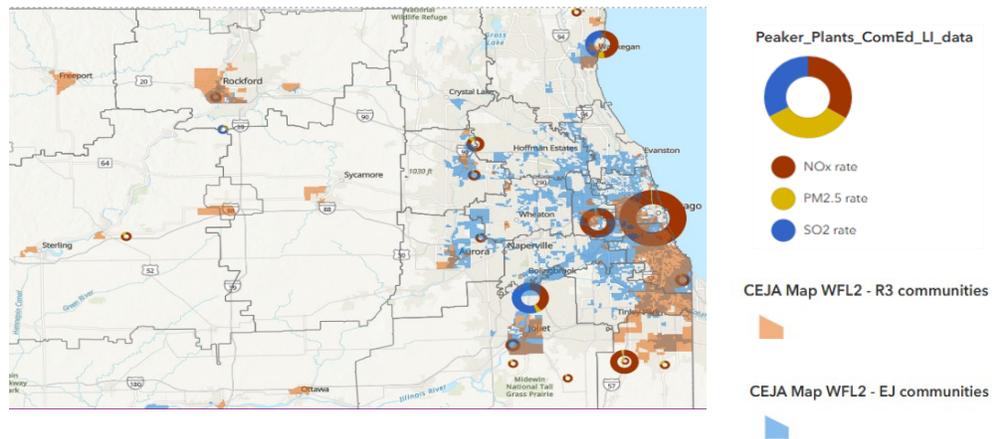


Figure 1. Input Data Layers Used in the Spatial MCDA

The Importance of Participatory Planning and Outreach

While the study’s findings underscore that there are community benefits to be seen with bidirectional charging technologies, technical solutions alone are not enough to ensure equitable outcomes. Participatory planning and outreach activities help ensure that planned programs and investments reflect actual community conditions, particularly for LI, EJ and R3 communities.

Guidance from national research organizations—including the Lawrence Berkeley National Laboratory¹⁸ and community based EV engagement resources such as [Charging Ahead: How Communities Can Power the Future of EVs](#)—indicates that gathering structured feedback from residents and local organizations helps identify practical barriers, improve program design and increase awareness of available benefits.

Why Engagement Matters

Community engagement provides utilities and decisionmakers with information that may not be evident through technical modeling alone. Input from residents and local institutions can help identify:

- Barriers to participation such as cost, access or infrastructure availability
- Local priorities such as reliability, safety or potential use cases for bidirectional charging
- Conditions that may influence participation, including housing type, parking access or awareness of EV programs

Approaches to Consider

Participatory planning generally includes:

- Public meetings or listening sessions to share information and collect feedback
- Collaboration with local organizations to improve awareness
- Communication materials that are clear and accessible.

Charging Ahead also highlights the usefulness of community-focused events—such as informational sessions or EV demonstrations—that allow residents to ask questions, learn about available incentives and understand how EVs and charging technologies work.

Outreach Considerations

Effective outreach typically includes:

- Targeted communication for LI, EJ and R3 communities
- Partnerships with trusted local groups
- Providing information in multiple languages and formats

These practices support transparency and help align future bidirectional charging efforts with community needs, ultimately helping ensure that programs are accessible and benefits reach customers who stand to gain the most.

Want to learn more?

Learn more about bidirectional charging at the [Backup Power Capabilities - ComEd Customer Innovation](#) webpage. Visit the ComEd [V2G Pilot Program](#) webpage to learn how you can participate or benefit from upcoming initiatives. For additional information on ComEd's available resources and programs, please visit [ComEd.com/EV](#).

¹ U.S. Department of Housing and Urban Development. (2024). *FY 2024 Income Limits Summary for Illinois*. Retrieved from huduser.gov/portal/datasets/il/il2024/2024summary.odn

² Illinois Criminal Justice Information Authority. *Restore, Reinvest, Renew Program (R3)*. Retrieved from r3.illinois.gov/

³ Illinois Solar for All Program. *Environmental Justice Communities Map*. Retrieved from illinoisfa.com/environmental-justice-communities/

⁴ LI refers to Low-Income, EJ is Environmental Justice communities, and R3 is Restore, Reinvest, and Renew communities. EJ + R3 are also often referred to jointly as "Equity Investment Eligible Communities (EIEC)". Retrieved from: energyequity.illinois.gov/resources/equity-investment-eligible-community-map.html

⁵ Lou, J., Shen, X., Niemeier, D.A. et al. Income and racial disparity in household publicly available electric vehicle infrastructure accessibility. *Nat Commun* 15, 5106 (2024). doi.org/10.1038/s41467-024-49481-w

⁶ Yu, Q., Que, T., Cushing, L.J. et al. Equity and reliability of public electric vehicle charging stations in the United States. *Nat Commun* 16, 5291 (2025). doi.org/10.1038/s41467-025-60091-y

⁷ Center for Sustainable Energy. *Addressing Barriers to EVI Deployment in Disadvantaged Communities*. energycenter.org/thought-leadership/research-and-reports/addressing-barriers-evi-deployment-disadvantaged

⁸ California Energy Commission & Union of Concerned Scientists. (2024). *EV Charging Equity Workgroup Report*. etcommunity.org/wp-content/uploads/2024/03/EV-ChargingEquityWorkgroupReport.pdf

⁹ Pacific Northwest National Laboratory. (2023). *Modernization Plan Equity Paper*. pnnl.gov/sites/default/files/media/file/MOD-Plan%20Equity%20Paper%20Final.pdf

¹⁰ Pacific Northwest National Laboratory. (2023). *Resilience & Equity Performance Metrics*. pnnl.gov/sites/default/files/media/file/2023%20Springer%20Journal_Resilience%20%26%20Equity%20Performance%20Metrics.pdf

¹¹ National Renewable Energy Laboratory. (2024). *Embedding Equity into Community EV Readiness Planning*. NREL Technical Assistance Sheet. docs.nrel.gov/docs/fy24osti/90148.pdf

¹² Lawrence Berkeley National Laboratory. (2023). *Electric Vehicle Program Designs and Strategies to Enhance Equitable Deployment (EV Equity Principles Report)*. eta-publications.lbl.gov/sites/default/files/ev_equity_principles_report_final.pdf

¹³ V2X ("Vehicle-to-Everything") refers to technologies that enable electric vehicles to exchange electricity with external systems, including the power grid (V2G), homes (V2H), and buildings (V2B). These approaches allow electric vehicles to supply power to or draw power from various sources beyond transportation.

¹⁴ Saaty, T. L. (1980). *The Analytic Hierarchy Process: Planning, Priority Setting, Resource Allocation*. New York: McGraw-Hill.

¹⁵ Hwang, C. L., & Yoon, K. (1981). *Multiple Attribute Decision Making: Methods and Applications*. Berlin: Springer-Verlag.

¹⁶ Illinois Power Agency. *Equity Investment Eligible Community Map*. Retrieved from: energyequity.illinois.gov/resources/equity-investment-eligible-community-map.html

¹⁷ Clean Energy Group. *Peaker Plant Mapping Tool*. Retrieved from: cleanenergygroup.org/initiatives/phase-out-peakers/maps/

¹⁸ Lawrence Berkeley National Laboratory. (2023). *Electric Vehicle Program Designs and Strategies to Enhance Equitable Deployment (EV Equity Principles Report)*. eta-publications.lbl.gov/sites/default/files/ev_equity_principles_report_final.pdf