XENDEE

Market Survey: Commercial EV Charging

Overcoming grid limitations and high costs with microgrids and government funding

ENDEAVOR BUSINESS INTELLIGENCE

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Introduction

Industry experts forecast sizable growth in electric vehicle (EV) sales, thanks to significant government incentives. With those funds and more stringent air emissions rules, the federal government projects EVs will make up 67% of new light-duty vehicle sales, 50% of new vocational vehicle sales, such as buses and garbage trucks, and 25% of new long-haul freight vehicles by 2032. The private sector has also committed $120 billion to the EV and battery supply chain since 2021.

While these actions herald impressive progress, there are still concerns about if, when, and how the United States will manage the transition to EVs, particularly to commercial EVs given the unique complications they present for both fleet owners and the electric grid.

To gain insight into the challenges and potential solutions related to commercial EV charging, Endeavor Business Intelligence and Xendee, an EV charging and microgrid design services provider, surveyed leaders involved in the development, operation, and commercial use of EV charging infrastructure.

The survey revealed three overarching themes:

1. **Electric grid limitations are the largest roadblock to the development and operation of EV charging infrastructure.**
2. **Costs remain a significant deterrent, making government incentives essential for the EV charging industry to grow.**
3. **Microgrids can be a solution for both the cost and electric grid challenges.**

This report provides insights into the survey data and takes a deep dive into the three key themes.

Costs remain a significant deterrent, making government incentives essential for the EV charging industry to grow.

Microgrids can be a solution for both the cost and electric grid challenges.

Electric Grid Limitations: The Largest Roadblock for EV Charging

Survey respondents are leaders in the manufacture, development, operation, and use of EV charging infrastructure for commercial vehicles. They are firsthand witnesses to how difficult it is to build and operate these projects. About 70% of survey respondents agree or strongly agree that electric grid limitations will constrain the growth of commercial EVs.

Respondents identified the most significant roadblocks to rolling out charging infrastructure for commercial EVs. They named electric grid limitations the most significant, followed by permitting and construction challenges and, equipment costs.

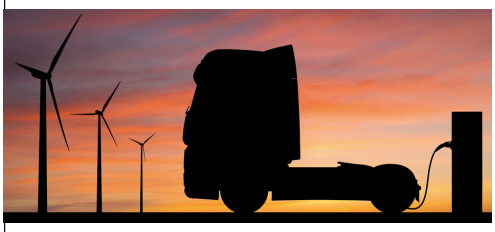
INFRASTRUCTURE ROLLOUT ROADBLOCKS

69% Electric grid limitations

Which of the following are significant roadblocks to the rollout of EV charging infrastructure for commercial EV usage?

	Very significant 5	4	3	2	Not very significant 1
Electric grid limitations	37%	32%	20%	7%	3%
Permitting and construction challenges/delays	24%	38%	26%	10%	2%
The total cost of EV charging infrastructure	21%	36%	26%	14%	3%
EV charging infrastructure supply chain challenges	17%	32%	33%	16%	2%
EV charging solutions are not adequate to support fleet operations	16%	31%	23%	21%	10%
Lack of financing for EV charging infrastructure	16%	23%	36%	16%	9%
Engineering costs	8%	22%	31%	27%	12%
Inadequate tools/software for the design of EV charging infrastructure	10%	17%	40%	21%	13%

Base: All respondents (n varies from I86 to I89).



About 70% of survey respondents agree or strongly agree that electric grid limitations will constrain the growth of commercial EVs.

At the project-by-project level, 42% of respondents identified grid tie-in requirements, such as interconnection approval, as a top make or break factor for an EV charging infrastructure project.

MAKE OR BREAK FACTORS

43% Operating cost
42% Grid tie-in requirements
41% Government incentives

Please select the top 3 factors that make or break a proposed EV charging infrastructure project.

- 43% Cost to operate infrastructure (e.g., cost of electricity, land rental agreements)
- 42% Utility grid tie-in requirements (e.g., interconnection approval)
- 41% Availability of government incentives (e.g., grants, tax breaks)
- 34% Customer demand for charging service
- 24% Ability to tie into DER or microgrid technology
- 24% Utility rate structure (e.g., utility time of use rates)
- 24% EPC costs
- 19% Permitting/regulatory approval process
- 18% Organizational goal to transition to or expand EV fleet
- 18% Operational cost savings
- 2% Other

Base: All respondents (n = 184); multiple answers allowed.

Polling a subset of survey respondents who design, develop and build charging infrastructure or distributed energy resource (DER) projects, more than 60% said their projects would benefit from ways to better evaluate utility support and grid constraints during project design.

When respondents were asked to describe specific pain points that analysis tools could help them solve, comments included requests for tools that:

- Reveal the "best locations to build EV charging stations based on distribution system studies."
- Allow a "better, easier process for interfacing and partnering with our local power utility or developing standardized designs and interconnection details for smaller DER and EV charging facilities. Right now, every site must be approached as a custom install, and it takes forever."
- Show "grid availability without a costly study."

"Right now, every site must be approached as a custom install, and it takes forever."

– Survey respondent

When all survey respondents were asked to name the most important factors for deciding where to locate commercial EV charging infrastructure, choosing a site "convenient for commercial EV fleet operations" came out on top. Ranking second among important location factors and returning to the theme of grid limitations being a top concern, 78% said the ability of existing or promised utility electric grid infrastructure to accommodate expected charging load was important or very important. That was followed closely by access to government incentives (73%) and operational cost savings (70%) as the most important factors for deciding where to locate commercial EV chargers. Government incentives and cost savings are both closely related to organizations' need to deliver a strong economic case for investments in EV charging.

IMPORTANCE OF INFRASTRUCTURE LOCATION

49% Convenient for commercial EV fleet operations

How important are the following factors when it comes to deciding where to locate EV charging infrastructure?

	Very important 5	4	3	2	Not important at all 1
Convenient for commercial EV fleet operations	49%	35%	11%	3%	1%
Existing or promised utility electric grid infrastructure can accommodate expected charging load	40%	38%	16%	5%	1%
Access to government grants, tax breaks or other incentives	39%	34%	17%	8%	2%
Operational cost savings	46%	24%	24%	3%	2%
Available connections to existing or planned DERs or microgrids	32%	35%	22%	8%	3%
Beneficial for charging service (CaaS) customers	31%	30%	27%	9%	4%

Base: All respondents (n varies from 178 to 180).

The survey posed a similar question about location decision-making only to those who design, develop, build, and operate EV charging infrastructure and DER projects. Chief among their concerns were practical project management issues like choosing charging sites where the grid was ready to support EV charging infrastructure or where DERs could be co-located with the project.

VARIABLES WHEN RANKING LOCATIONS

50% Utility electric grid readiness
41% Available government incentives
39% Ability to add supporting DERs

How important are the following variables when ranking the potential of EV charging locations?

	Very important 5	4	3	2	Not at all important 1
Utility electric grid readiness	50%	32%	14%	3%	1%
Available government incentives (e.g., local, state, federal tax breaks, grants, or rebates)	41%	30%	17%	9%	3%
Ability to add supporting DERs behind the meter	39%	37%	20%	4%	0%
Operational needs (e.g., proximity to fleet routes, co-location at a commercial facility)	38%	39%	16%	7%	0%
Utility tariffs – time of use demand and consumption charges	37%	35%	23%	4%	1%
Utility EV/electrification programs	32%	36%	23%	7%	2%
Traffic data	33%	34%	26%	5%	3%
Permitting requirements	32%	32%	29%	7%	1%
Demographic data	25%	31%	31%	11%	2%

Base: Developers, Manufacturers, Owners, Utilities (n varies from 100 to 104).

Note that utility tariffs are also rated among the most important variables when choosing an EV charging location. Utility tariffs such as consumption charges and time of use demand charges can be a huge risk to the financial viability of a company's commercial EV charging plans, and they are essential variables to include when doing financial modeling for a project.

Government Funding Is Essential to Overcome Cost Challenges

Federal government goals for EV sales and public EV chargers, backed by significant funding, have undeniably shaped the market.

The Biden administration has set goals for EVs to account for 50% of all new vehicle sales and for 500,000 public chargers to be available nationwide by 2030. The Inflation Reduction Act (IRA) extended and expanded tax credits for new and used light-duty EVs as well as commercial EVs. It extended and expanded the tax credit for new EV charging infrastructure to a maximum of $100,000 per unit, up from $30,000 previously. It also includes $3 billion to electrify the U.S. Postal Service's massive fleet and $1 billion for heavy-duty EVs for local governments and schools.

The Bipartisan Infrastructure Law (BIL) of 2021 committed over $7 billion to boost the EV materials supply chain and $7.5 billion for EV charging infrastructure investments. All federal government light-duty fleet vehicle purchases must be zero-emission vehicles (ZEVs) by 2027 and heavy-duty vehicle purchases must be ZEVs by 2035. A new vehicle emissions rule proposed by the Environmental Protection Agency in April 2023, if adopted, would be a powerful catalyst to spur the consumer market and auto manufacturers toward EVs.

Survey respondents expect significant growth in commercial EVs in the coming years, though perhaps not quite to the level of the Biden administration's goals. About a third of respondents expect 10%-25% of light- and medium-duty commercial vehicles in the U.S. and Canada will be EVs by 2035, another third expect commercial EVs to account for 26%-50% of commercial vehicles, and 15% expect more than half of commercial vehicles to be EVs. The transition has begun, with the International Energy Agency reporting that light-duty commercial EV sales surged 90% globally to 310,000 EVs sold in 2022, though that still accounted for a small percentage of total commercial vehicle sales.

Survey respondents who identified as fleet operators provided some data to suggest a somewhat slower EV transition is unfolding for commercial fleets. Within the next five years, 90% of fleet operators said 25% or less of their fleet vehicles would be electric. None predicted more than half of their fleets would be comprised of EVs in that time frame.

50% of respondents expect more than 26% of commercial vehicles to be EVs by 2035.

EXPECTED EV GROWTH BY 2035

50% Predict growth of 26% or more

What percentage of light- and medium-duty commercial vehicles (e.g., rental cars, delivery fleets, private fleets, bus fleets, government/ municipal fleets) do you believe will be electric by 2035 in the U.S. and Canada?

15%	More than half
35%	26%-50%
36%	10%-25%
13%	Less than 10%

Base: All respondents (n = 192).

EXPECTED EV OWNERSHIP IN 5 YEARS

90% Fleet operators predict 25% or less EVs

What percentage of commercial vehicles owned or operated by your organization do you expect to be EVs within 5 years?

59%	Less than 10%
31%	10%-25%
10%	26%-50%
0%	51%-75%
0%	More than 75%

Base: All respondents (n = 29).

An outlook for commercial EV sales that is somewhat short of Biden administration goals aligns with the expectations of major auto manufacturers, which have dialed back predictions for the EV market. In 2021, auto executives on average predicted 65% of all new vehicle sales would be EVs by 2030. One year later, executives revised their forecast, predicting 35% of new vehicle sales would be EVs by 2030.

If the federal government is to hit its EV sales and charging infrastructure goals, government funding is likely to be the primary driver to get there. Survey respondents identified several strategies to recover the cost of EV charging infrastructure investments, but government grants, tax credits, and other incentives stood out as the most significant factor helping businesses overcome cost hurdles.

INVESTMENTS DUE TO INCENTIVES

29% Making additional investments
49% Considering additional investments

The Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA) include significant federal government incentives for EV charging infrastructure and EV purchases. How much additional investment will your organization make in new EV charging infrastructure due to these incentives?

- 10% More than $1.5 million of additional investment
- 5% $500,001 to $1.5 million of additional investment
- 6% $100,001 to $500,000 of additional investment
- 6% $10,001 to $100,000 of additional investment
- 2% $500 to $10,000 of additional investment
- 49% We are considering additional investment but have not decided
- 21% No additional investment

Base: Respondents (n = 176).

The BIL and IRA are clearly driving new investment in commercial EV charging infrastructure. Nearly a third of respondents quantified additional investments their companies are making due to BIL and IRA incentives, while 49% of respondents said the laws have pushed their companies to consider making additional investments.

Demonstrating further how the two laws are moving the needle, survey respondents on average said they expect to complete 12 EV charging infrastructure projects in the next five years and that, on average, nine of those projects would not be completed without BIL and IRA incentives. That means 75% of EV charging infrastructure projects in the next five years are reliant on those laws.

COMPLETED PROJECTS IN 5 YEARS

27% Expect to complete more than 25

How many EV charging infrastructure projects does your organization expect to complete within the next five years?

- 27% More than 25
- 8% 11-25
- 27% 4-10
- 29% 1-3
- 9% 0

Average: 12

Base: All respondents (n = 178).

RELIANCE ON BIL AND IRA INCENTIVES

78% Planning projects due to laws

How many EV charging infrastructure projects does your organization expect to complete within the next five years that it WOULD NOT have developed without BIL and IRA incentives?

- 17% More than 25
- 10% 11-25
- 20% 4-10
- 31% 1-3
- 22% 0

Average: 9

Base: All respondents (n = 162).

6 in 10 respondents said they expect to take advantage of government incentives to recover EV charging infrastructure investment costs.

COST RECOVERY METHODS

60% Government grants and tax credits

How do you expect to recover the cost of EV charging infrastructure investments? (Please select all that apply)

- 60% Government grants, tax credits, and other incentives
- 47% Direct revenue from customer use of charging service
- 36% Cost savings for my organization
- 33% Increased sales of other products/services attributable to charging service
- 17% Not applicable

Base: All respondents (n = 184); multiple answers allowed.

OPTIONS FOR COST RECOVERY

27% Government grants and tax credits
26% Spending not recovered
20% Customer use of charging service

Please enter the percentages each of the following options will contribute to recovering the cost of EV charging infrastructure investments.

- 27% Government grants, tax credits, and other incentives
- 26% Portion of spending that will not be recovered
- 20% Direct revenue from customer use of charging service
- 15% Cost savings for my organization
- 12% Increased sales of other products/services attributable to charging service

Base: All respondents (n = 138). Average percentages are reported.

Note that 47% of survey respondents expect direct revenue from charging-as-a-service (CaaS) to help them recover the cost of charging infrastructure investments. The average respondent expected CaaS to provide a smaller percentage of cost recovery than government incentives. These findings indicate a market reality in which billing customers to charge can't cover the costs and risks associated with EV charging infrastructure alone. If the true cost of the investment was reflected in CaaS pricing, the cost of charging would be too high. Customers would be hard to come by. CaaS offerings do have a significant role in contributing to the overall investment case, though, in combination with other factors such as government incentives and the ability for organizations to grow sales for other products and services by offering EV charging.

Findings indicate a market reality in which billing customers to charge can't cover the costs and risks associated with EV charging infrastructure alone.

Microgrids and DERs Can Be Solutions to Electric Grid and Cost Challenges

Limitations of the electric grid in serving commercial EVs and their charging infrastructure will be exposed in the coming years, given DC fast chargers are expected to increase 60-fold by 2050 and Level 2 chargers are expected to increase 30-fold in that time. The high charge rate of those devices is the cause of significant concern in utility grid operation centers throughout North America.

The industry has its eye on a potential solution: microgrids and DERs.

When asked to name the likely power sources for their EV chargers, 76% of survey respondents selected grid power. However, 69% also said they're likely to employ microgrids and DERs. Furthermore, when respondents were asked to select their top 3 "game-changing technologies" to stimulate the transition to commercial EVs, 68% chose microgrids and DERs co-located with EV charging infrastructure — more than any other technology.

> When asked to name the likely power sources for their EV chargers, 69% said they're likely to employ microgrids and DERs.

TECHNOLOGIES TO STIMULATE TRANSITIONS

68% DERs and microgrids co-located with EV charging infrastructure

Please select the top 3 game-changing technologies for stimulating the transition to commercial EVs and EV fleets.

- 68% DERs and microgrids co-located with EV charging infrastructure
- 62% Hardware and/or software solutions to enhance control of EV charging infrastructure (real-time control of EV charging schedules and other logistics such as charging cost management)
- 57% Utility electric grid modernization technologies (e.g., real-time monitoring, autonomous grid control and optimization)
- 41% Vehicle-to-everything (V2X) solutions (e.g., vehicle-to-grid, vehicle-to-infrastructure, vehicle-to-device, vehicle-to-vehicle, etc.)
- 26% Software to optimize EV charging infrastructure location selection
- 17% Software to streamline the design of optimized EV charging infrastructure
- 4% Other

Base: Respondents (n = 183); multiple answers allowed.

POWER SOURCE CONSIDERATIONS

76% likely or very likely grid power from the utility

How likely are you to use the following power sources for future EV charging infrastructure?

	Very likely 5	4	3	2	Not very likely 1
Grid power from the utility	58%	18%	12%	11%	0%
Power from company-owned DERs and microgrids	44%	25%	20%	7%	0%
Power from third-party owned and operated DERs and microgrids	20%	26%	24%	12%	18%
Power secured through power purchase agreements (PPAs or VPPAs) from third-party generation sources	18%	16%	30%	18%	18%

Base: Developers, Manufacturers, Owners, Utilities (n varies from 105 to 107).

Co-locating microgrids and DERs with EV charging infrastructure is perhaps the most important trend in successfully rolling out EV charging infrastructure. More than 80% of survey respondents agree or strongly agree that microgrids and DERs are essential to the growth of commercial EV usage, and 63% believe those assets will help overcome electric grid limitations.

When asked to choose only the most compelling reason microgrids and DERs should be used to support commercial EV charging, nearly 60% of surveyed business leaders said because those technologies deliver improved electric reliability and operational resilience. Again, the theme that microgrids and DERs help commercial EVs do their job in the face of grid limitations rises to the top.

REASONS FOR DER AND MICROGRID USAGE

57% Improved electric reliability and operational resilience

What is the most compelling reason DERs and microgrids should be used to support commercial EV charging?

57%	Improved electric reliability and operational resilience
18%	Reduced total cost of electricity to charge commercial EV fleets
9%	Decreased greenhouse gas emissions from operations
3%	Branding/marketing/sales benefit of using "green energy" for EV charging
8%	Other
5%	There is no compelling reason

Base: All respondents (n = 186).

Respondents filled in their own additional reasons DERs and microgrids should be used, including:

- "To avoid expensive grid capacity upgrades"
- "Faster timeline to implement and flexibility/scalability"
- "Multi-purpose benefits for batteries."

Asked to name the generating assets that were most important to co-locate with EV charging infrastructure, 78% of survey respondents said microgrids (which combine DERs with smart controls), and 65% named solar PV plus battery energy storage systems (BESS).

> When asked to name the generating assets most important to co-locate with EV charging infrastructure, 78% said microgrids.

However, only 54% said microgrids are currently or will be integrated with charging infrastructure they own, and 51% said the same for solar PV plus BESS configurations. That means there's more appetite for co-locating these more complex generating systems than what is currently being installed.

Does this data mean multiple generating technologies in systems such as microgrids will be deployed to support EV charging more often in the future? Only time will tell, but the findings suggest a desire for that outcome.

TECHNOLOGY FOR CO-LOCATION AND INTEGRATION

78% Microgrids most important to co-locate
54% Microgrids for current or future integration

What three generating technologies do you think are most important to co-locate with EV charging infrastructure? (Please select the top three.)	*Which technologies are currently integrated or will be integrated with EV charging infrastructure your organization owns, uses or develops? (Please select all that apply.)*	
78%	54%	Microgrids (combining one or more DER with the ability to operate in an independent island or grid-connected mode)
65%	51%	Solar PV + BESS
34%	36%	Battery energy storage systems (BESS)
25%	32%	Solar PV
22%	28%	Diesel or natural gas generators
15%	14%	Fuel cells
13%	10%	Wind
5%	6%	Other

Base: All respondents (n varies from 185 to 188).

Survey responses indicate business leaders may be already searching for a solution to that gap. When asked what capabilities would improve the development or operation of new EV chargers, the top answer was a solution to optimize EV charging infrastructure with supporting technologies like microgrids and DERs.

CAPABILITIES FOR PROCESS IMPROVEMENTS

65% Optimization of EV charging infrastructure with supporting technologies during engineering and design (e.g., DERs, microgrids)

What capabilities would improve the process of developing and/or operating new EV charging infrastructure? (Please select all that apply.)

- 65% Optimization of EV charging infrastructure with supporting technologies during engineering and design (e.g., DERs, microgrids) to match expected charging needs
- 62% Evaluation of utility support and utility electric grid constraints during engineering and design
- 52% Evaluation of potential cost savings or revenue generation during engineering and design
- 41% Data analytics and insights on charging-as-a-service (CaaS) utilization
- 39% Optimization of scheduling EV fleet charging during engineering and design
- 37% Ranking and selecting potential EV charging locations
- 7% Other

Base: Developers, Manufacturers, Owners, Utilities (n=106); multiple answers allowed.

Additional comments regarding what capabilities would improve the infrastructure development process also reveal challenges where respondents are looking for solutions to help.

We would want to:

- "Determine the optimal number, spacing, and charge rate of chargers necessary to support a fleet of given specifications."
- "Optimize the potential cost savings of DERs and/or BESS storage co-located with EV chargers for a given fleet use case and charging regime."
- "Know if we could be more cost-effective in generating our own electricity vs utilizing the grid."
- "Know what utility programs we could utilize to sell back (or just be available) to the grid for additional revenue sources."

> EV charging infrastructure developers, operators, and users are working with DER and microgrid providers to create more cost-effective and operationally efficient solutions.

Conclusion

The Endeavor Business Intelligence/Xendee survey revealed consistent themes: Cost and grid limitations challenge the rollout of the EV charging infrastructure needed to support the transition to commercial EVs, but government incentives and co-located microgrids and DERs are available solutions.

An alliance between the EV charging infrastructure industry and the distributed energy solutions industry is quickly developing. EV charging infrastructure developers, operators, and users are working with DER and microgrid providers to create more cost-effective and operationally efficient solutions. These efforts are helping more charging infrastructure projects avoid lengthy utility interconnection queues, years-long waits for local utilities to complete necessary grid upgrades, and high costs associated with interconnection and grid upgrades.

Developing EV charging infrastructure supported by a co-located microgrid and funded by a robust package of government incentives is not easy, however. EV charging infrastructure developers and owners need planning and design solutions to put all the pieces in place. Success requires expert partners like Xendee to help you navigate the complex framework of decisions and provide data and insights to optimize the design, engineering, and operation of your projects.

Our Survey Methodology

Xendee commissioned Endeavor Business Intelligence to conduct a research study among subscribers of Endeavor publications to investigate commercial EV charging infrastructure development. The data was collected between March 28, 2023, and April 21, 2023, and garnered 214 responses. The margin of error for 214 responses at the 95% confidence level is +/- 7.7%.

All survey respondents had some relationship with EV charging infrastructure. Four in 10 said their organizations developed microgrids or DERs that incorporate EV charging infrastructure, 22% said their organizations were considering the use of EV charging infrastructure, 18% sell or install EV charging infrastructure, 16% were piloting the use of EV charging infrastructure, 15% offer EV CaaS to customers, 13% own EV charging infrastructure and 9% work at organizations where using EV chargers is an important part of day-to-day operations. More than a third of respondents identified as senior executives, while other large groups by job role included project management/development (17%), sales and marketing (13%), operations (10%), and maintenance (6%).

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