Facilitating the Integration of Electric Vehicles in Ontario

Survey of Local Distribution Companies and EV Charging Service Providers

Prepared for:

Ontario Energy Board

Submitted by:

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Executive Summary

The Ontario Energy Board (OEB) engaged Guidehouse in October 2022 to design and conduct two surveys as part of its Electric Vehicle Integration (EVI) initiative. One survey was designed for Local Distribution Companies (LDCs), and one survey was designed for electric vehicle (EV) charging service providers in Ontario. The surveys launched on November 30th, 2022. Respondents were advised that their answers would be aggregated to preserve anonymity. Guidehouse's analysis of results was based on survey responses received as of survey closing on December 21st, 2022.

The primary objective of the surveys was to inform actions the OEB may take to ensure that EVs and EV charging infrastructure can be efficiently integrated with Ontario's electricity system. OEB staff provided areas of interest and high-level objectives to guide survey development. Guidehouse worked with the OEB to develop the two surveys to address the following:

- Determine to what extent LDCs already know where EVs are charging in their region and have grid visibility.
- Identify potential information sources or processes by which LDCs could increase their EV visibility on the grid.
- Identify traditional (e.g., transformer upgrade) and non-traditional (e.g., managed EV charging) ways in which utilities could manage the EV charging load.
- Identify approaches to system investments to prepare for EV adoption.
- Identify issues EV charging service providers face when working with LDCs and opportunities to address them in a cost-effective manner.
- Identify regulatory barriers LDCs face regarding making system investments that support EV charging equipment.
- Identify regulatory barriers EV charging service providers face regarding connecting their equipment to the electricity grid.

For the LDC survey, Guidehouse ensured representativeness by tracking response rates to ensure coverage from each region – GTA and Central Ontario, East Ontario, Southwest Ontario, Northeast Ontario, and Northwest Ontario – customer count and port size. Guidehouse followed up with participants in areas of low responsiveness which included targeting LDCs in the Northern regions to ensure perspectives from those regions were captured. Guidehouse received 35 complete responses for the LDC survey representing 35 unique LDCs and approximately 87% of LDC customers in the province.

For the EV charging providers survey, Guidehouse conducted an analysis to determine a representative sample of charging providers in Ontario. Guidehouse prioritized charging providers based on Level 2 and Level 3 port quantities and ensured targeted follow up was done with respondents to ensure most installed ports in the province were captured. Guidehouse received responses from seven EV charging service providers in Ontario representing approximately 80% of all installed publicly accessible ports in the province. These providers collectively have installed/operate nearly 4,000 public Level 2 charging ports, and nearly 1,000 public Direct Current Fast Charging ("DCFC") ports. Guidehouse analyzed the responses received and summarized the feedback provided.

Feedback by the LDC survey respondents was:

- LDC respondents reported that many of their organizations did not have a public guide in relation to the connection of EV chargers to the distribution system.
- LDC respondents reported a desire to improve their visibility of EV connections and their ability to forecast EV demand.
- LDC respondents reported a desire for more clear guidelines to follow when bringing forth a business case related to investments in EV integration.
- LDC respondents reported that requirements to enable managed charging and vehicle-to-grid integration may be required in the future.
- LDC respondents reported a desire for greater clarity on which investments could be paid for through rates.

Feedback by the survey respondents for the charging provider survey was:

- EV charging service providers reported a lack of clarity and consistency related to expected cost sharing formulas, roles, and responsibilities for EV infrastructure developments, together with concerns related to high upfront costs.
- EV charging service providers reported a desire to explore alternative rate structures to address demand charges for DCFC infrastructure with low utilization.
- EV charging service providers reported a lack of streamlined communication between LDCs and EV charging service providers.
- EV charging service providers reported challenges in obtaining information to aid in the planning and development of EV infrastructure.

1. Introduction and Objectives

The Ontario Energy Board (OEB) was asked to take steps to facilitate the efficient integration of electric vehicles (EVs) into the provincial electricity system in the Minister of Energy's Mandate Letter of November 2021.[1] The Minister's Letter of Direction from October 2022 confirmed support for the OEB's workplan in relation to EV integration, with the OEB intending to review issues pertaining to system readiness, delivery costs and connections.

In September 2022, the OEB launched the Electric Vehicle Integration (EVI) initiative to inform actions the OEB may take to ensure the efficient integration of EVs with the electricity system in Ontario. The initiative outlines a plan to undertake this work with three key areas of effort. The first area of effort was focused on conducting a survey to identify barriers to the deployment of EV charging infrastructure. The OEB engaged Guidehouse to design and conduct two surveys:

1. One survey for Local Distribution Companies (LDCs) in Ontario
2. One survey for EV charging service providers in Ontario

OEB staff provided areas of interest and high-level objectives to guide survey development, shown in Table 1-1 for the LDC survey and Table 1-2 for the EV charging service provider survey.

Table 1-1 High-Level OEB Objectives for LDC Survey

Area	High-Level Objective(s)
Nature of Risk	• Understand LDC assessment of the risk that EV connections pose to distribution system, and their level of readiness for addressing that risk.
Approaches to Planning and Proposing Investments	• Understand how LDCs are conceiving "enabling" and "proactive" investments, and how this translates to regulatory guidance they may benefit from.
Visibility of EV Connections	• Understand LDCs' degree of confidence in knowing where EV connections are located, and to what level of detail. • Determine information sources used to develop forecasts, for locations and types of chargers. • Identify information sources for operating profiles. • Understand how LDCs are improving their visibility on EV connections, and what they may seek from the OEB to facilitate this.
EVs in Forecasts and System Plans	• Understand LDCs' degree of confidence in forecasting EV load (for rates) and to inform system plans (for specific investments).

[1] Letters of Direction formerly called Mandate Letters.

Area	High-Level Objective(s)
	• Identify ways in which LDCs are seeking to improve their capabilities in this area.
Instances of Escalation of Rate Class	• Determine extent to which customers have been escalated to new rate class as a result of EV connections, or the degree to which this has been a concern on the part of customers.
Managed Charging (Smart Charging)	• Determine whether LDCs have explored managed charging, and to what level of maturity such programs have been developed, and for which customer types this is seen as beneficial. • Assess whether LDCs have established or identified technical standards to facilitate managed charging programs (similar to technical interconnection requirements for Distributed Energy Resources [DERs]).
Connections	• Identify barriers and opportunities related to interconnection requirements and practices (including cost, process and technical dimensions).
Means to Minimize Distribution Costs	• Assess the ways in which LDCs have worked with customers to minimize the cost of distribution upgrades.
Means to Mitigate Demand Charges	• Assess the ways in which customers have mitigated demand charges (e.g., load management, behind-the-meter DER).

Table 1-2. High-Level OEB Objectives for EV Charging Service Provider Survey

Area	High-Level Objective(s)
Characteristics	• Understand EV charging service provider size, geographic coverage and model of operation.
Planning Deployments	• Understand service provider planning process and information requirements with respect to the electricity system.
Connection Barriers	• Understand features of the connection process that may have created challenges for the service provider.
Delivery Costs	• Understand concerns related to demand charges.
Best Practices	• Explore jurisdictions seen as favourable to charger deployment, and key drivers for that assessment.

2. Development of Survey

2.1 Survey Logistics

Guidehouse worked with OEB staff to develop two unique surveys, one for LDCs and one for EV charging service providers. The surveys launched on November 30th, 2022. Respondents were advised that their answers would be reported in the aggregate to preserve anonymity, but that individual responses would be visible to OEB staff to enable future follow up. Guidehouse analysis of results is based on survey responses received as of survey closing on December 21st, 2022.

2.2 Development of LDC Survey

OEB staff provided Guidehouse with initial thoughts and documentation on areas of interest for the survey. Following multiple rounds of discussion, interactive polls and Guidehouse expert recommendations, OEB staff and Guidehouse finalized research topics and areas of interest for the survey. The following areas of interest were identified for the LDC survey:

- Challenges in connecting chargers
- Clarity on prudent investments
- Clarity on roles and mandates
- Instances of escalation of rate class
- LDC visibility of EVs
- Load forecasting & system planning
- Managed charging/smart charging
- Nature of risk from EVs
- Related resources and initiatives

A list of questions for each topic was developed based on documentation and guidance provided by OEB staff and expanded using Guidehouse's in-house expertise. The initial master survey instrument contained several questions for each area of interest. Each area of interest was limited to three to six questions, and to limit survey length and aid in ensuring survey completion, some questions were removed from the final survey.

To develop the list of LDC respondents, Guidehouse conducted a census of all the LDCs in Ontario. OEB staff contacted all LDCs in Ontario to determine the appropriate contact for each organization. Additionally, Guidehouse also leveraged its internal contacts as alternative options for consideration.

2.2.1 Representativeness of LDC Survey

To ensure the feedback received from LDCs was representative of views and experience across the province, Guidehouse tracked responses from participants across geographic regions, by

distribution of customer count, and by total load size (kW) of the LDC. Using the census of LDCs in Ontario, Guidehouse grouped each LDC into the following regions:

- GTA and Central Ontario
- East Ontario
- Southwest Ontario
- Northeast Ontario
- Northwest Ontario

Guidehouse tracked response rates to ensure coverage from respondents by region, and customer count/load size. Guidehouse followed up with participants in areas of low responsiveness. This included targeting utilities in the Northern regions to ensure voices from those regions were included in the survey.

At the time of survey completion, LDCs representing approximately 87% of customers in the province had replied to the survey[2]. Additionally, Guidehouse received at least one response from an LDC in each of the five regions identified.

2.3 Development of EV Charging Provider Survey

Similar to the development of the LDC survey, Guidehouse worked with the OEB to finalize research topics and areas of interest for the EV charging provider survey. The following areas of interest were identified for the EV charging provider survey:

- Characterize size, geographic coverage and business model
- Identify connection barriers
- Identify demand charge concerns
- Understand process for planning where chargers are deployed

A list of questions for each topic was developed based on documentation and guidance provided by the OEB and expanded upon using Guidehouse's in-house expertise. To limit survey length and aid in ensuring survey completion, some questions were removed from the final survey.

To develop the list of EV charging provider survey respondents, Guidehouse leveraged its internal contacts, and supplemented this list with contacts provided by the OEB. Guidehouse chose the primary list of charging provider contacts based on installed port counts in Ontario according to the database by the Alternative Fuels Data Center.[3] OEB staff also invited interested EV charging service providers to participate in the survey through a communication on the EVI Engage with Us website.

[2] OEB. *Natural Gas and Electricity Utility Yearbooks.* https://www.oeb.ca/ontarios-energy-sector/performance-assessment/natural-gas-and-electricity-utility-yearbooks#elec

[3] Alternative Fuels Data Center. *Electric Vehicle Charging Station Locations*. https://afdc.energy.gov/fuels/electricity_locations.html#/analyze?fuel=ELEC

2.3.1 Representativeness of EV Charging Provider Survey

To ensure that analysis was representative of EV charging station deployment experience within the province, Guidehouse conducted an analysis to determine a reasonable sample of charging providers to represent Ontario. Guidehouse prioritized charging providers based on Level 2 and Level 3 port quantities.

Guidehouse ensured targeted follow up was done with respondents to ensure a majority of installed ports in the province were captured. At the conclusion of the survey, charging providers representing over 80% of installed ports[4] in Ontario had replied to the survey.

[4] This figure includes non-networked ports, as defined by the Alternative Fuels Data Center, in the total count of ports. Removing non-networked ports from the total count of ports brings the representativeness up to cover 90% of charging providers in the province.

3. Survey Results

The LDC survey was divided into the following sections:

- Section 1 – Nature of Near-Term Risk from EVs
- Section 2 – EVs in Load Forecasts
- Section 3 – LDC visibility of EVs
- Section 4 – Clarity and Additional Guidance
- Section 5 – Approaches to Planning Investments
- Section 6 – Challenges in Connecting Chargers
- Section 7 – Instances of Escalation of Rate Class
- Section 8 – Managed Charging/Smart Charging
- Section 9 – Related Resources and Initiatives

The corresponding survey results are summarized from subsections 3.1.2 to 3.1.10 below.

3.1 Results of LDC Survey

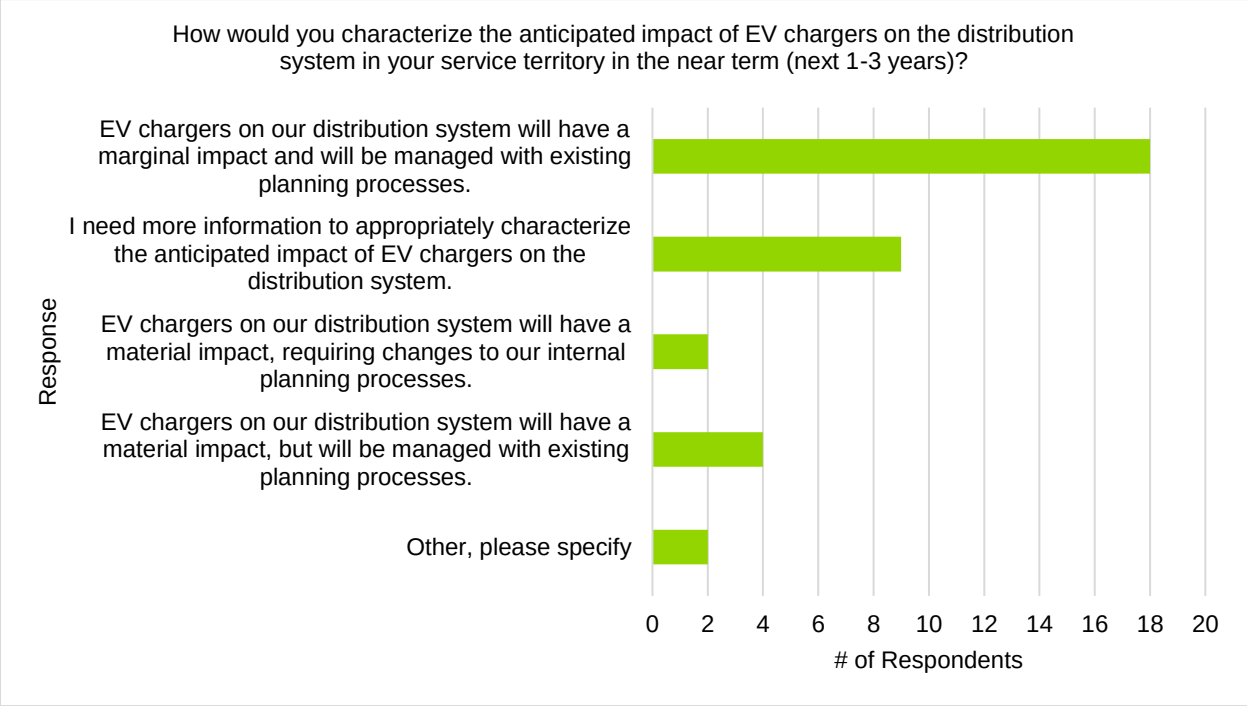
3.1.1 Response Rate

Guidehouse received responses representing 35 unique LDCs and approximately 87% of customers in the province. In instances where multiple responses were received from representatives of a single entity, Guidehouse consolidated the responses or used the most complete response received for analysis. Unless otherwise stated, Guidehouse generated figures and tables based on the exact count of responses (i.e., most votes) received for each answer choice within a question. In instances where this approach varied (i.e., the mean etc. was used), the figure or table indicated as such.

3.1.2 Nature of Near-Term Risk from EVs

The first section of this survey was intended to identify LDC's assessment of the near-term risk that EVs pose to the distribution system, and their level of readiness for addressing that risk. When asked to characterize the anticipated near-term impact of EV chargers on the distribution system within each LDC's respective service territory, most respondents stated there will be a marginal impact on their distribution system that will be managed with existing planning processes. Figure 3-1 shows responses for the anticipated impact of EV chargers on the distribution system in the near term (next 1-3 years).

Figure 3-1 Anticipated Near-Term Impact of EV Chargers on Distribution System



When asked to rank charging type by risk to distribution system, respondents indicated their rankings as summarized below (1 is the highest risk and 5 is the lowest risk):

1. Residential Charging
2. Commercial Fleet Charging (Level 2, Level 3)
3. Public Charging (Level 3)
4. Public Charging (Level 2)
5. Workplace Charging (Level 1, Level 2)

3.1.3 EVs in Load Forecasts

As EVs represent a growing electric load in the province[5], the ability to forecast growth in the service territory will become increasingly important. The intent of this portion of the survey was to understand the degree of confidence LDCs have in forecasting EV load to inform system planning and the establishment of rates, and to identify means to improve their capabilities.

The majority of survey respondents indicated that currently they do not separately account for EV load in their load forecasts for the purpose of proposing rates (note that this does not necessarily mean that load from EVs is not captured in the load forecasting methodology used by the LDC). Six respondents indicated that the EV load in their forecasts is based on statistical techniques using historical data (e.g., regression analysis or diffusion modeling) and five

[5] IESO. *The Future of Electricity Demand in Ontario*. https://www.ieso.ca/en/Powering-Tomorrow/2021/The-Future-of-Electricity-Demand-in-Ontario

respondents stated that EV load is calculated based on manual adjustments to an existing load forecast.

The primary source for EV forecasting as indicated by respondents was the usage of in-house forecasts. Three respondents indicated that forecasts developed by third parties (produced by consultancies or syndicated research) and publicly available forecasts were primarily used to aid in their EV load forecasting. Two respondents stated that a hybrid model based on in-house data and publicly available data was used. When prompted to assess the confidence in the accuracy of their current forecast of demand from EVs, most respondents indicated that they were Somewhat Confident', with an equal number of respondents stating they were 'Confident' and 'Not Very Confident'. No respondent selected "Not at all Confident".

With respect to primary sources for future forecasts, most respondents indicated that they foresee themselves relying more on third party and publicly available forecasts. Three respondents indicated that they would rely on in-house data in the future and one respondent stated that they would likely begin with in-house data and transition to forecasts developed by third parties in combination with data and analysis from the Independent Electricity System Operator (IESO) and local municipality. Some respondents indicated that in most cases, forecasts need to be adjusted to represent the unique characteristics within each service territory and that the main limitation with using third party/publicly available forecasts is that they are not geographically specific to the LDC's service territory. One respondent stated that since EV adoption is foreseen to be driven by government policies, it would make sense for these forecasts to be provided by a government agency.

3.1.4 LDC Visibility of EVs

This section of the survey was intended to understand the level of visibility LDCs have on EV connections, how they might be improving their visibility in the future and what they are seeking from the regulator to improve this visibility.

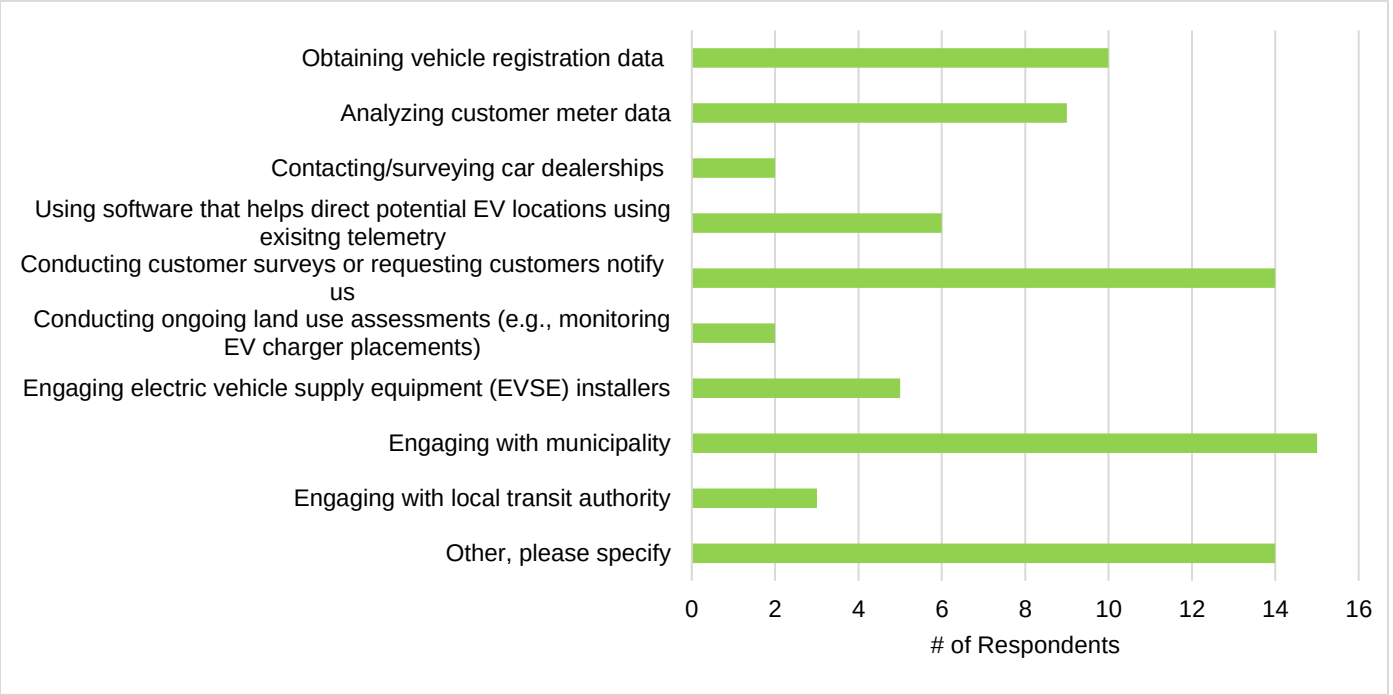
Respondents of the survey reported lower confidence about the location of residential chargers within their service territory – currently, there is not a process requiring residential customers to inform their LDC directly about the purchase of an EV. The next highest level of uncertainty was related to workplace chargers within their service territory. Respondents were most aware of the location of Level 3 public chargers in their service territories. Commercial charging did not place as it did not receive the majority ranking in any position (from 1 – 5) by respondents. The rankings for EV charger location awareness are summarized below (with 1 being not confident at all and 5 being very confident):

1. Residential Charging
2. Workplace Charging (Level 1, Level 2)
3. Public Charging (Level 2)
4. Public Charging (Level 3)
5. Public Charging (Level 3)[6]

LDCs reported a variety of sources of information to understand the location of EV charging on the distribution system, as shown in Figure 3-2 below.

[6] Public Charging (Level 3) received the most selections from respondents for 4th and 5th place. For 4th place Public Charging (Level 3) received 11 votes and Commercial Charging received 7 votes. For 5th place Public Charging (Level 3) received 9 votes and Commercial Charging received 4 votes.

Figure 3-2 Utility Actions to Understand where EV Charging is Taking Place



Respondents that selected 'Other' specified the following as actions they were taking to understand where EV charging is taking place within their service territories:

- Implementing measures to collect information directly from customers
- Obtaining Electrical Safety Authority data on EV charging station installations

3.1.5 Clarity and Additional Guidance

Another goal of this survey was to explore respondents' understanding of their role in facilitating EV adoption in the province, and to explore additional guidance that may be required in this area.

Respondents indicated several areas where they might benefit from additional guidance or support from the OEB. They are summarized below:

- Clarity related to circumstances where LDCs can own, control, and dispatch EV chargers.
- Clarification for LDCs on how to make investments in make-ready infrastructure / programs. This includes investments to improve grid visibility and support continued EV adoption.
- Clarification on how EV integration will impact rate base, whether alternative rate structures can be established and whether full or partial costs can be recovered.
- Clarification on whether distributed energy resources ("DERs") for grid services and smart grid deployment can be included in rate base, if utilities find DERs can be used to manage grid impacts due to EV charging.

- Clarity on an LDC's ability to provide incentives to encourage participation in a managed charging program.
- Communication and education information from the OEB that utilities can share with customers concerning EV chargers and impacts on the grid.
- Coordination with the Ministry of Transportation and the Electrical Safety Authority for a regular and standardized reporting of EV registrations and charger installations within the LDC territory.
- Encouragement for LDCs to engage and educate customers and become a "trusted partner" to improve EV integration.
- Guidance from the OEB regarding vehicle-grid integration policy and planning, such as enabling utilities to take an active role in managing EV charging load.
- LDC role in the development of a charging network – i.e., optimal siting, EV charging stations in rural areas.
- Clarification on new funding models or sources, or investment categories necessary to support EV adoption, including guidance on whether costs should be distributed across all ratepayers and not only customers that will benefit from EVs.
- Clarity on how the OEB (and intervenors) will assess EV-related spending proposals.
- Guidance on applying expansion and cost recovery methods to unforecasted changes in a residential customer load where it necessitates an expensive infrastructure upgrade.
- Guidance on how to approach the incremental spending anticipated, as well as if special treatment is prudent for incremental costs associated with oversizing equipment in the near term to address anticipated growth attributed to EVs.
- Guidance related to expectation for LDCs to support atypical voltage offerings due to prevalence of a voltage standard for charging equipment in other jurisdictions (e.g. 480V for certain chargers in the United States) and customer demand to be served at this voltage.
- Support in understanding EV forecasts for the province and by region.

Respondents were prompted to rate areas of uncertainty their organization may have with respect to their role in EV adoption and integration. Table 3-1 below shows the results, where a score of 1 represents the lowest level of uncertainty (most certain) and a score of 5 represents the highest level of uncertainty.

Table 3-1 LDC Areas of Uncertainty Regarding Role Related to EV Adoption/Integration

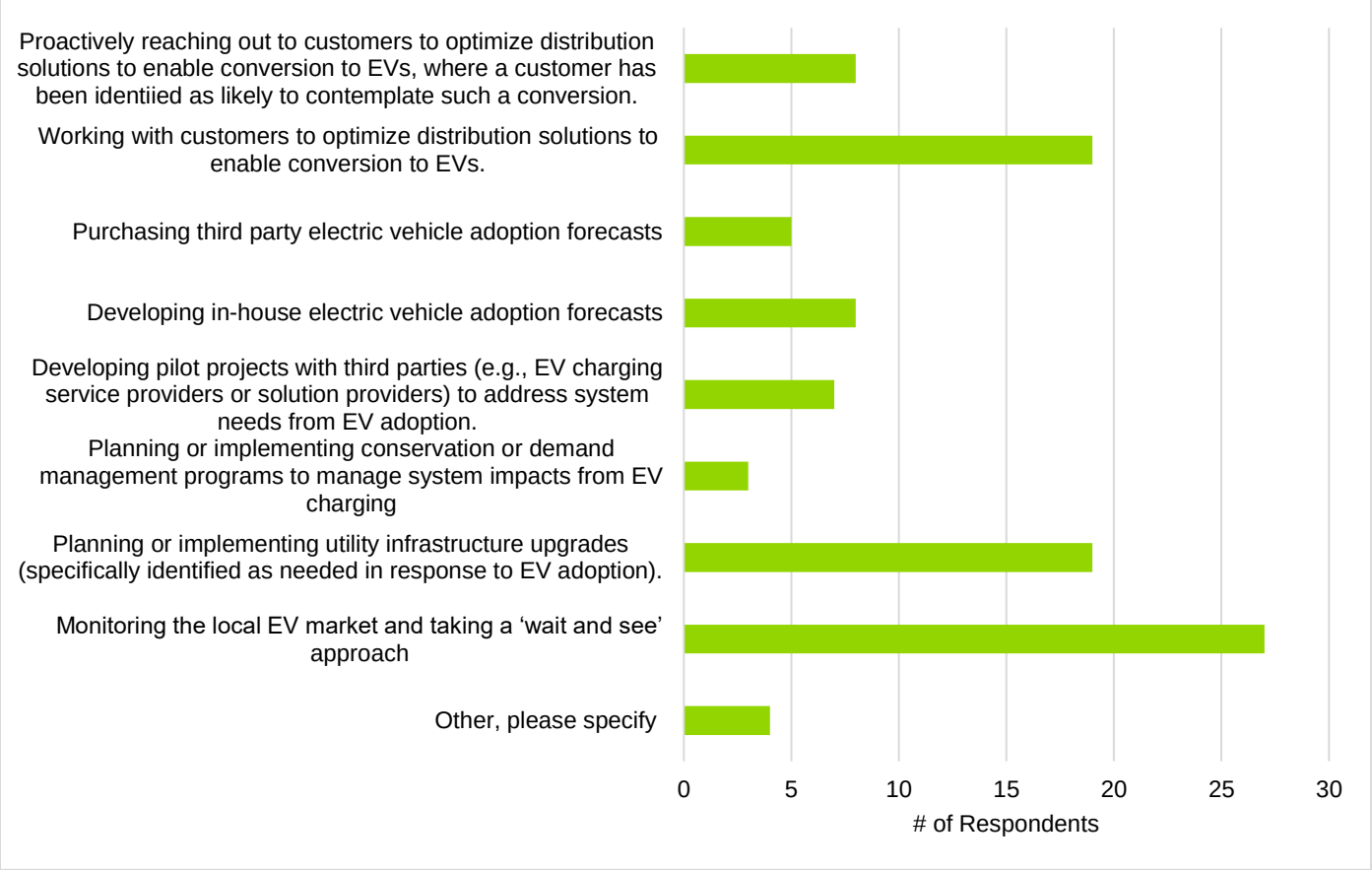
Area of Uncertainty	Majority Rating
Regulatory considerations related to how new, non-wires solutions (including conservation and demand management) may be deployed to address system needs arising from growing EV adoption	4
Your organization's ability to identify locations where EV adoption will occur at a sufficiently granular level to inform distribution system planning	4
Technical considerations related to how new, non-wires solutions (including conservation and demand management) may be deployed to address system needs arising from growing EV adoption	3
The type of infrastructure your organization would be permitted to own and operate in relation to EV charging	3
Your organization's ability to forecast the pace at which EV adoption will occur across the service territory	3
Changes in technology related to EVs, and the impact this may have on your organization's system plans	3
The current role of your organization with respect to EV integration	2

Respondents indicated that they have low uncertainty surrounding their current role with respect to EV integration but are much less certain about regulatory considerations related to how non-wires solutions may be deployed to address system needs from EV adoption, and their ability to identify locations where EV adoption will occur.

3.1.6 Approaches to Planning Investments

With the growing adoption of EVs, prudent investments to help manage new load have become significantly more important. This section aimed to understand how LDCs are conceiving proactive investments and what regulatory guidance may be needed to support these investments. When asked how the LDC is currently addressing challenges from anticipated EV adoption, respondents answered as shown in Figure 3-3 below.

Figure 3-3 Utility Approaches to Address Challenges from Anticipated EV Adoption



Respondents that selected 'Other' specified the following as approaches they take to address challenges from anticipated EV adoption:

- Considering longer term potential EV implications when considering longer term investments. Structuring investments to enable future upgrades and avoid "scrapping" where possible.

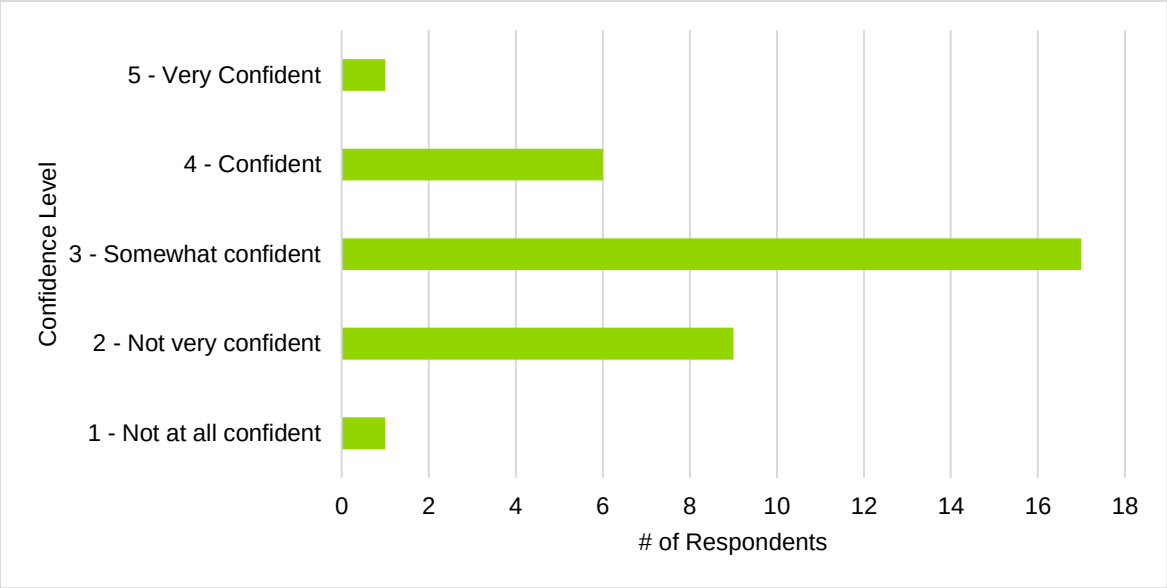
- Enhancing capability to forecast EV adoption and distribution system impacts by planning customer communication and outreach activities and examining regulatory changes that could enhance EV adoption.

When survey respondents were asked to assess how confident they were in bringing forward a business case related to investments associated with EV adoption, most respondents indicated they were "Not very confident" or "Somewhat confident", as seen in Figure 3-4. When prompted to identify the primary contributing factor to the LDC's lack of confidence in developing a business case related to investments associated with incorporating EV adoption, respondents identified the following as the primary contributing factors:

- Investments related to long term forecasted but unconfirmed growth

- Lack of existing load data on a granular level within service territory
- Lack of knowledge regarding the technologies and system requirements that may be needed to support and manage EV charging activities
- Lack of technical standards in the EV space to support planning activities
- Uncertainty around exact locations of EV charging and charging patterns
- Uncertainty around funding mechanism and ability of LDC's to include charger assets within rate base

Figure 3-4 LDC Confidence Level in Bringing Forth an EV Investment Business Case



3.1.7 Challenges in Connecting Chargers

This section of the survey aimed to identify barriers to adoption related to interconnection requirements. Respondents ranked challenges associated with interconnection as follows (with 1 being the most challenging and 4 being the least challenging):

1. Cost challenges
2. Technical challenges
3. Process challenges
4. Other challenges

Respondents were also asked to elaborate on their choice of ranking. A summary of their responses is shown on Table 3-2 below.

Table 3-2 Summary of Interconnection Challenges Choice of Ranking

Cost Challenges	Process Challenges	Technical Challenges	Other Challenges
Customers will request to be moved up to 200A services from 100A services. This will result in significant underground residential development costs. Upgrading existing infrastructure means significant cost increases. Limited annual spend won't be enough to keep pace with EV growth.	Processes for connection currently not in place within the LDC. No regulatory process currently in place for customers to inform the LDC of EVs on the distribution system. Limited staff to process increasing amount of service upgrades. No process to accommodate EV growth. Treatment of separately metered connections. Alignment with developer need to build in short timelines with limited notice.	Technical challenges as technology evolves with EV integration. Ensuring correct voltage/capacity at a given location during connection is often a challenge. Increased technical studies are required as EV integration is happening quicker than anticipated. Complex interconnectivity and protection of the distribution grid presents many technical challenges. Need for additional tools, datasets, skills to forecast EV load to inform planning.	Regulatory challenges (i.e., when a customer request triggers the need for an upgrade, will the LDC be able to address this as a traditional economic evaluation process). Customer engagement to consider demand response and willingness to provide the LDC control of their chargers. Capacity constraints. Customer awareness of charger connection costs, prior to purchase of EV.

Most utilities currently do not have a publicly available guide or process for the connection of EV chargers as shown in Figure 3-5. However, most utilities do have designated staff for guiding customers through the connection process for EV charger deployments as shown in Figure 3-6.

Figure 3-5 LDC Availability of Guides/Processes for EV Charger Connections

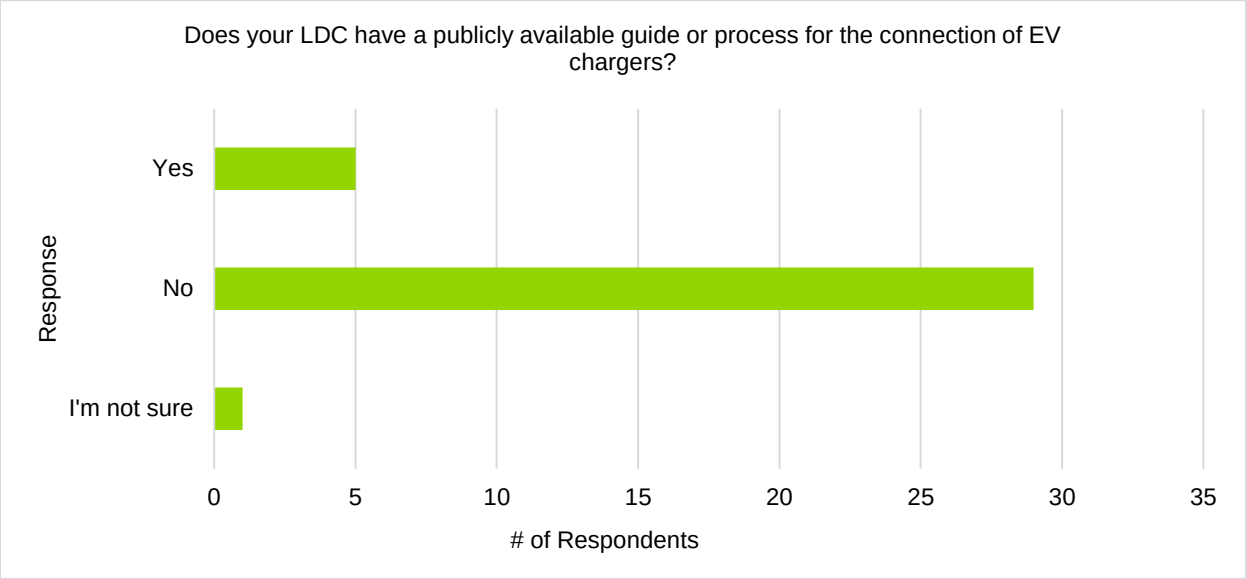
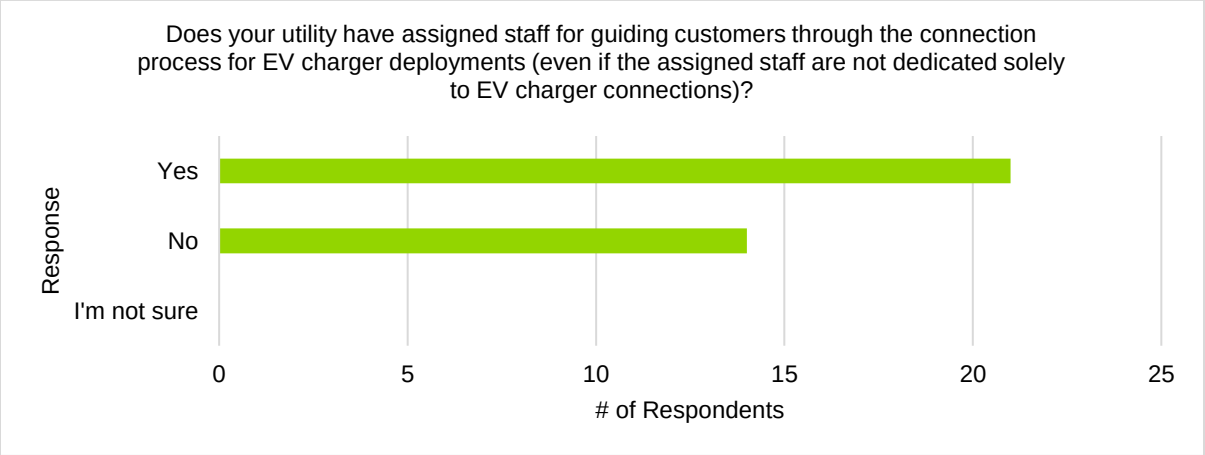


Figure 3-6 LDC Assigned Staff for Connection Process



When asked to rate the extent to which LDCs believe that concerns related to connection costs have served as a barrier for customers to connect EV chargers to the distribution system,

respondents rated as shown in Table 3-3 below.1 being not a barrier to 5 being a significant barrier. Respondents were also presented with the option to select 'not sure'.

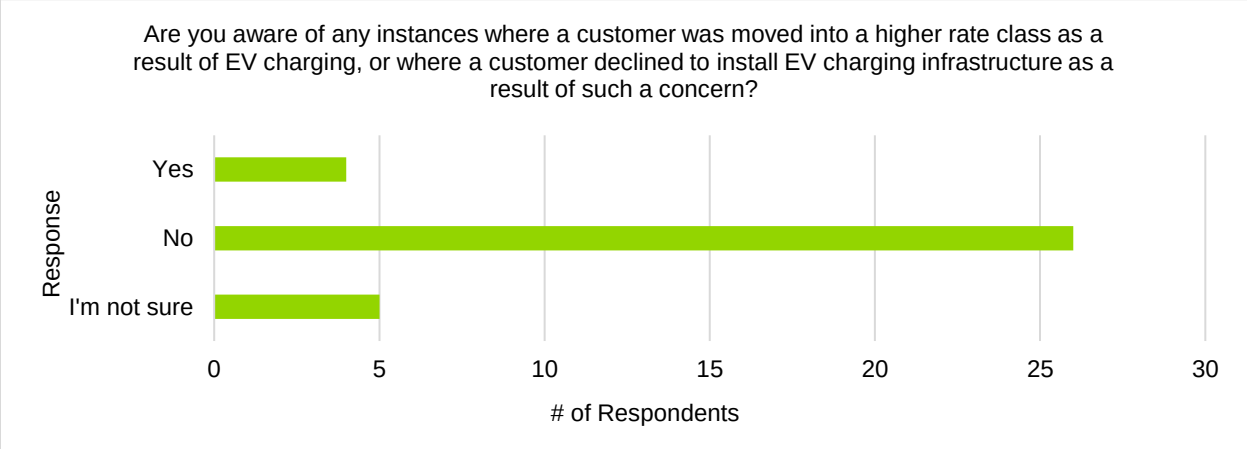
Table 3-3 LDC Ratings of Connection Cost Barriers

Barrier	Majority Rating
Connection costs for residential customers	1
Connection costs for public charging	2
Connection costs for workplace charging	2
Connection costs for commercial fleet charging	1/ not sure[7]

3.1.8 Instances of Escalation of Rate Class

Increased EV adoption can sometimes result in customers being escalated to a new rate class because of the new levels of demand. As shown in Figure 3-7, the majority of survey respondents indicated that they were not aware of instances where customers were escalated to a higher rate class as a result of EV charging.

Figure 3-7 LDC Awareness of Instances of Escalation of Rate Class



When asked to characterize the extent to which the concerns related to escalation to a new rate class is prevalent within each LDC's service territory, most respondents had not experienced such concerns. A handful of respondents had experienced single instances where this occurred, summarized below:

- A customer (EV charging station operated by a third-party) had been moved to a higher customer rate-class due to the third-party under-estimating the load and servicing requirements – the service was moved to a GS>50kW and an interval demand meter

[7] There was a tie between the selection of "1" and "not sure" by respondents. 8 respondents stated not a barrier and 8 respondents stated that they weren't sure.

installed because the monthly demand was above 50kW every month. The LDC does not believe this will be prevalent in their service territory in the near-term (2 years)

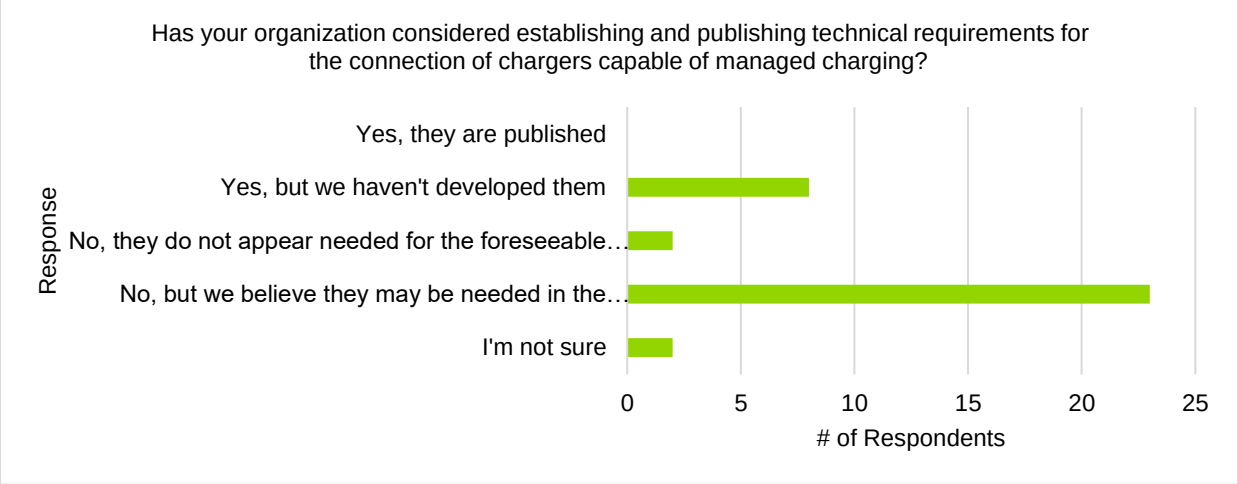
- A GS<50kW customer was deterred from installing a public charger because of the upfront costs and the ongoing additional costs of being a GS>50kW customer

3.1.9 Managed Charging/Smart Charging

Managed charging allows an LDC to remotely control EV charging to better correspond to the needs of the grid. The questions asked in this portion of the survey sought to determine whether LDCs owned EV charging infrastructure (for load management), determine whether LDCs have explored managed charging and explore the level of maturity of such programs. The questions in the survey were also used to assess whether utilities have established or identified technical standards to facilitate managed charging programs.[8]

Figure 3-8 below shows the responses from respondents when asked whether their organization has considered establishing and publishing technical requirements for the connection of chargers capable of managed charging.

Figure 3-8 LDC Establishment of Manuals for Managed Charging



[8] Similar to technical interconnection requirements for DERs.

Figure 3-9 below shows responses from LDCs when asked if their organization is considering the use of managed charging programs to mitigate the impacts of EV chargers on the distribution system.

Figure 3-9 LDC Consideration of Managed Charging Programs

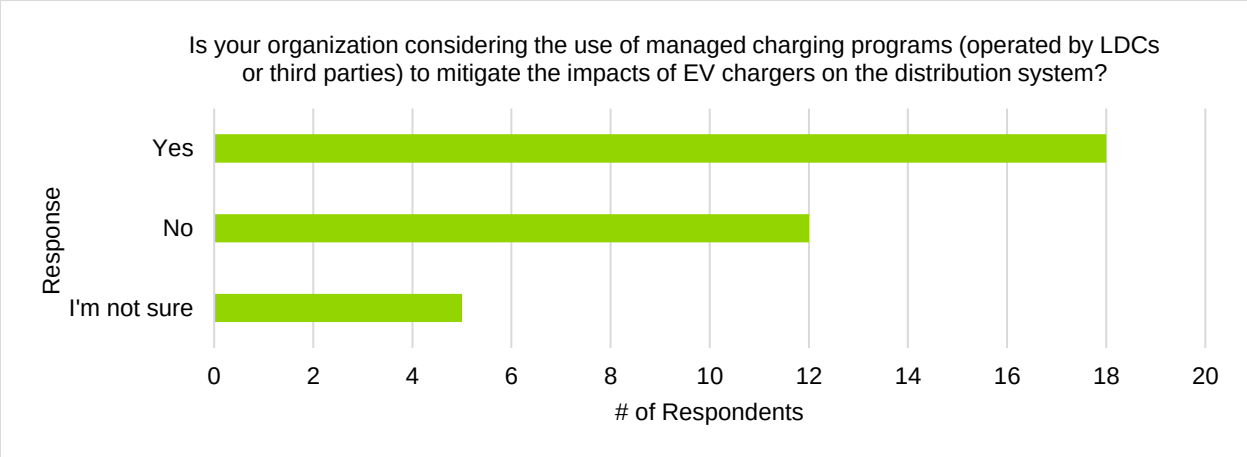


Figure 3-10 below shows responses from LDCs when asked if their organization currently owns or operates EV charging infrastructure that is capable of managed charging.

Figure 3-10 LDC Ownership of EV Charging Infrastructure Capable of Managed Charging

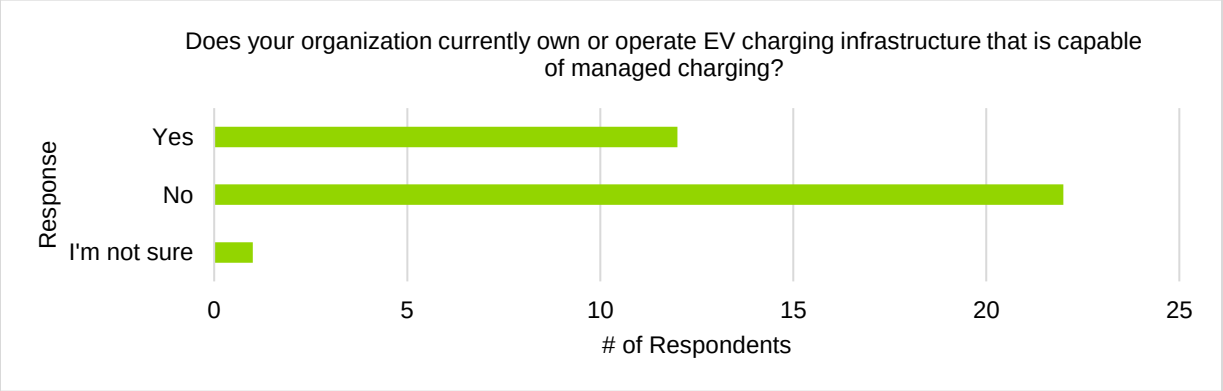


Figure 3-11 below shows responses from LDCs when asked about their awareness of EV charger deployments that are owned by third parties and capable of managed charging.

Figure 3-11 LDC Awareness of Third Party Owned EV Charger Deployments Capable of Managed Charging

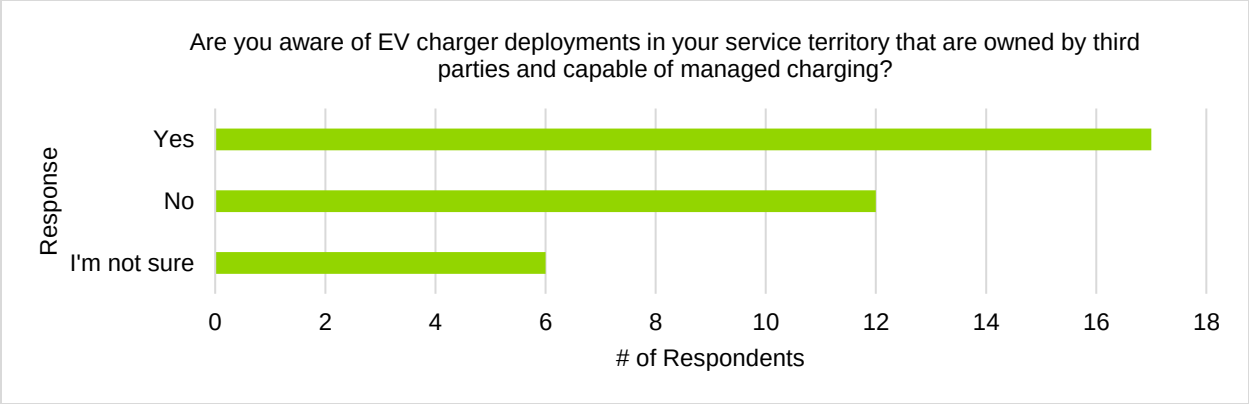
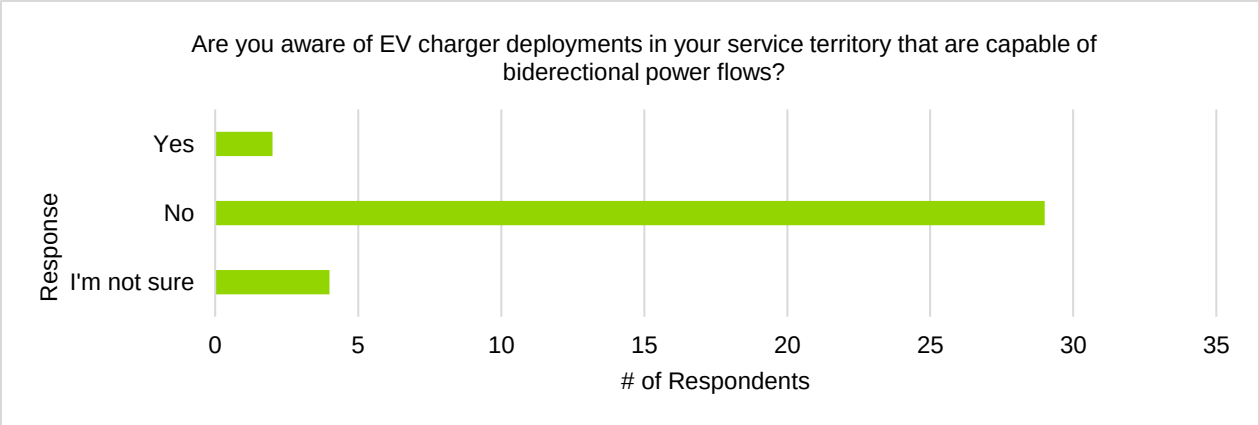


Figure 3-12 below shows responses from LDCs when asked about their awareness of EV charger deployments in their service territories that are capable of bidirectional power flows.

Figure 3-12 LDC Awareness of EV Charger Deployments with Bidirectional Power Flows



3.1.10 Related Resources and Initiatives

The sector has access to several EV-related resources and documentation. The survey prompted respondents to assess their familiarity with each resource/initiative by rating each into the following categories: aware and familiar, aware but unfamiliar and not aware. Table 3-4 below summarizes the count of responses by rating for each resource/initiative.

Table 3-4 LDC Awareness of EV-Related Resources and Initiatives

Resource/Initiative	Not Aware	Aware but Unfamiliar	Aware and Familiar
2016 OEB Staff Bulletin on EV Charging	5	14	16
2021 OEB Conservation & Demand Management Guidelines	4	12	19
2022 Regional Planning Process Advisory Group Load Forecast Guideline for Ontario	5	14	16
OEB Innovation Sandbox	4	11	19
OEB DER Connections Review	0	7	28
OEB Framework for Energy Innovation	2	9	24
Electrical Safety Authority data on EV charger installations	1	15	18
Ontario Dataset of EV Registrations by Forward Sortation Area	11	6	18
IESO Grid Innovation Fund	3	18	14
OEB Electric Vehicle Integration Initiative	6	16	13
OEB Energy Transition	9	13	13
OEB Enabling the Implementation of the Ultra-Low Overnight Price Plan	1	4	30
OEB Industry Relations Enquiry Process	3	9	23

3.2 Results of EV Charging Provider Survey

The EV charging service provider survey was divided into the following sections:

- Section 1 – Characterizing EV Charging Service Providers
- Section 2 – Connection Barriers
- Section 3 – Interaction with Local Distribution Companies
- Section 4 – Demand Charges
- Section 5 – EV Adoption in Ontario

The corresponding survey results are summarized from subsections 3.2.2 to 3.2.6 below.

3.2.1 Response Rate

Guidehouse received responses from seven EV charging service providers in Ontario. These providers collectively have installed / operate nearly 4,000 public Level 2 charging ports, and nearly 1,000 public Direct Current Fast Charging ("DCFC") ports – approximately 80% of all installed publicly accessible ports in the province today. For one service provider, Guidehouse received responses from two different people and together these provided further depth and did not overweight any responses. As a result, the two responses from the one service provider were incorporated into the survey responses. One respondent does not directly install ports but was treated as a charging service provider for the purpose of this survey. Unless otherwise stated, Guidehouse generated figures and tables based on the exact count of responses received for each answer choice within a question. In instances where this approach varied (i.e., the mean etc. was used), the figure or table indicated as such.

3.2.2 Characterizing EV Charging Service Providers

Respondents to this survey have a wide variety of experience in deploying EV charging infrastructure in Ontario and have varied experience in interacting with LDCs in the province. Multiple respondents indicated that they had worked with over 40 LDCs in Ontario to date – others have not yet worked with utilities in Ontario or have worked with ranging quantities from 0 to 40. The below figures provide the experience (both in years of installations and quantity of installed ports) of the survey respondents.

Figure 3-13 Experience (Years) in Deploying EV Infrastructure in Ontario

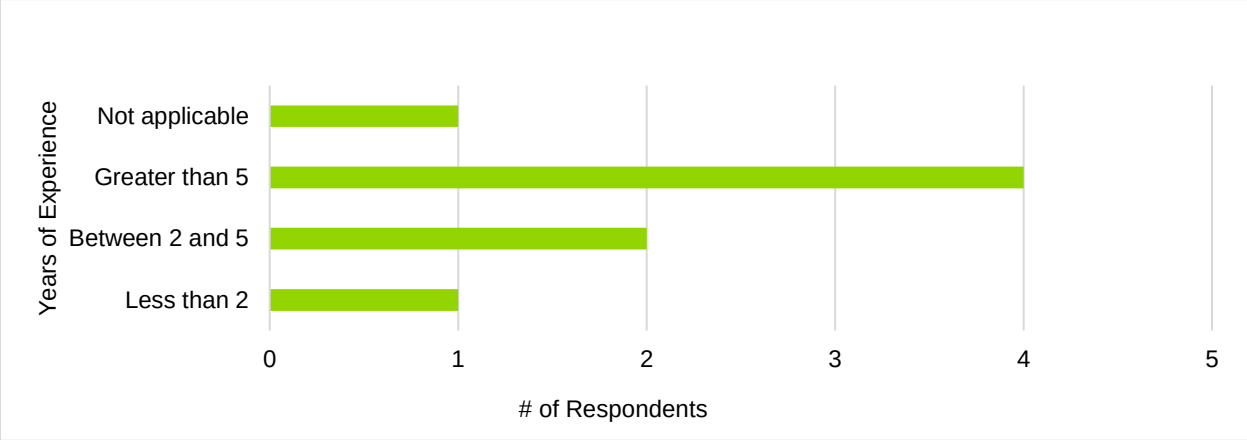
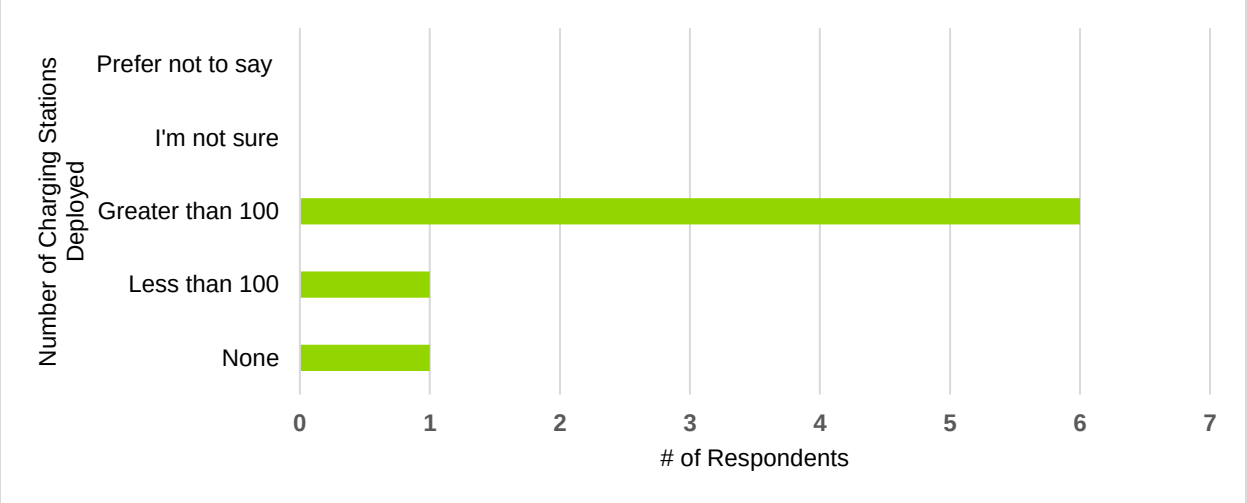
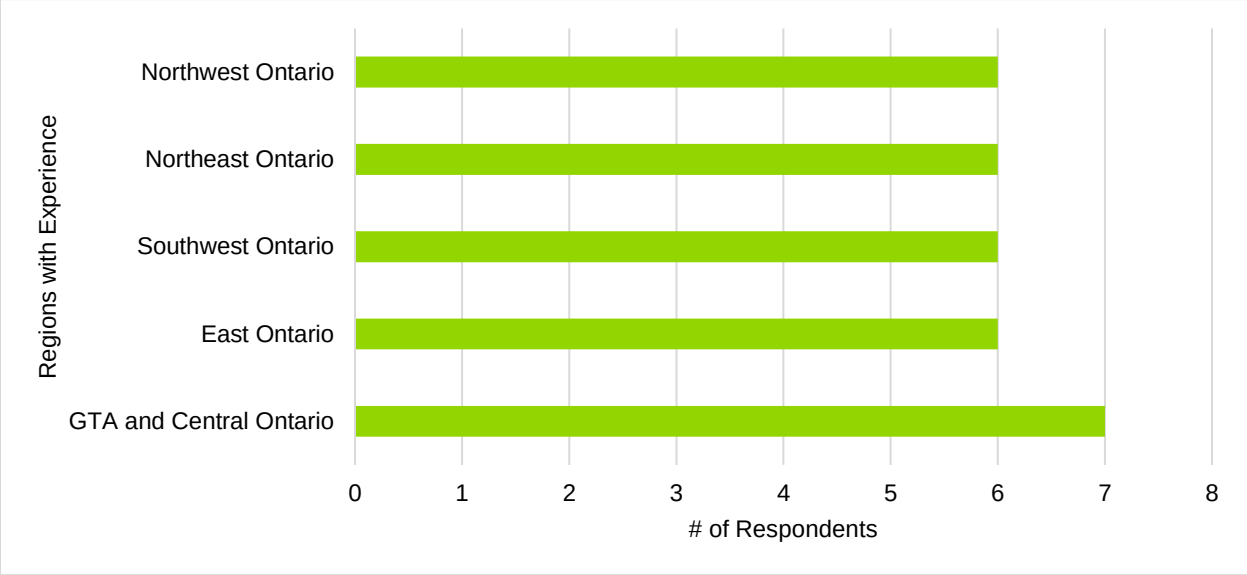


Figure 3-14 Experience (Quantity) in Deploying EV Infrastructure in Ontario



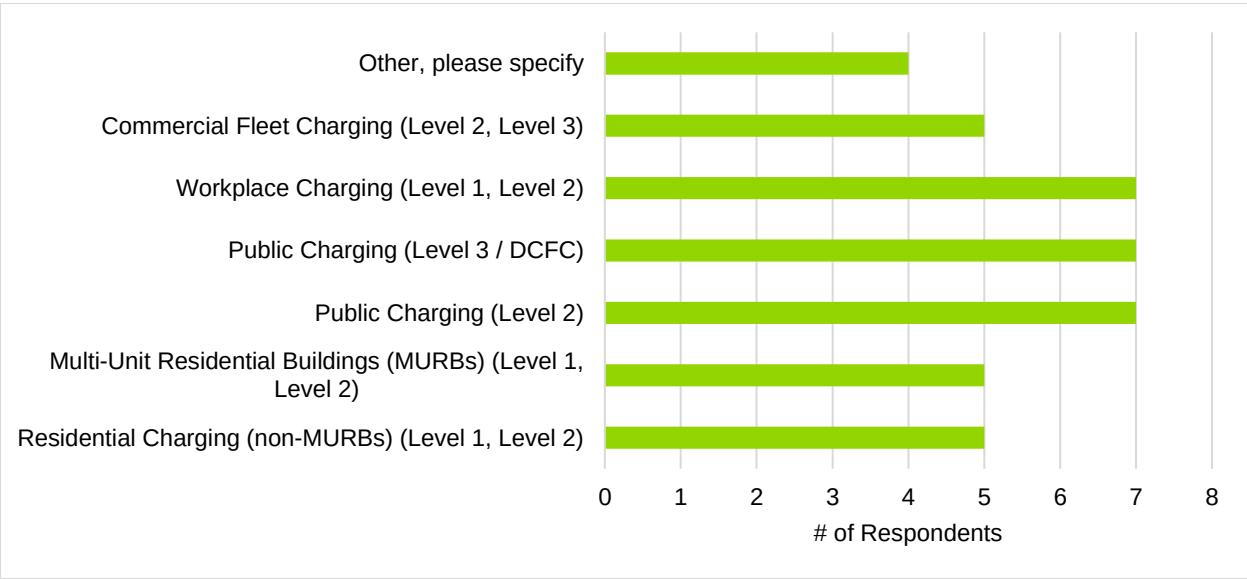
The respondents of this survey have experience deploying EV charging infrastructure province wide. Respondents were asked which regions they've installed EV charging infrastructure to date within the province. The below figure demonstrates the experience of respondents, and the breadth of experience across Ontario.

Figure 3-15 Experience (Geographic) in Deploying EV Infrastructure in Ontario



The respondents of this survey have a range of experience across segments of the EV charging ecosystem. The below figure indicates which segments of the ecosystem each charging service provider currently serves in Ontario. Responses for "Other" include mass transit, vehicle-to-building and vehicle-to-home services, white label services[9], and API integration.[10]

Figure 3-16 Segments Served by Respondents

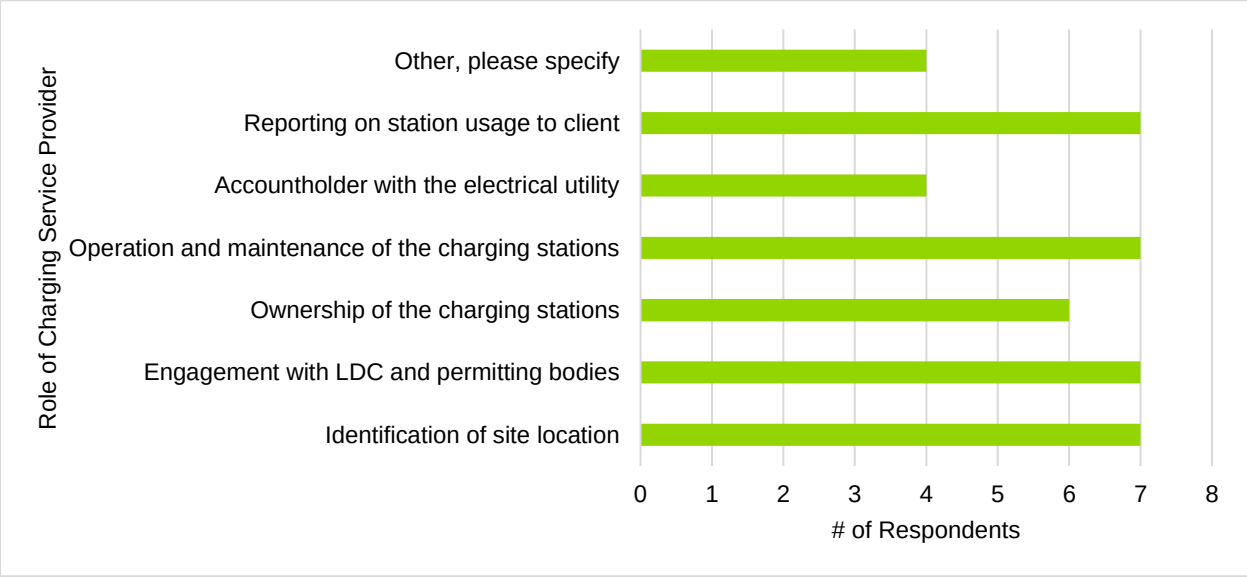


[9] Products which are manufactured by a third party but re-branded and sold by a different party.

[10] The connection of two or more applications for the exchange of data, via an application programming interface ("API")

Lastly, the respondents of this survey cover a variety of different roles within the EV charging ecosystem. A "charging service provider" can have varied responsibilities – selecting site locations, ownership of the infrastructure, maintenance, operations, etc. The below figure provides an overview of the roles that survey respondents indicated they perform. Responses of "Other" included answers such as construction management, policy and regulatory advocacy, and vehicle-to-grid integration.

Figure 3-17 Roles of EV Charging Service Providers



3.2.3 Connection Barriers

The first section of the survey aimed to identify barriers that EV charging service providers face when attempting to install EV charging infrastructure in the province. Respondents were asked to describe the primary challenges they've faced in planning EV charging infrastructure deployments in Ontario (e.g., while siting EV charging infrastructure). The most indicated barriers are summarized below.

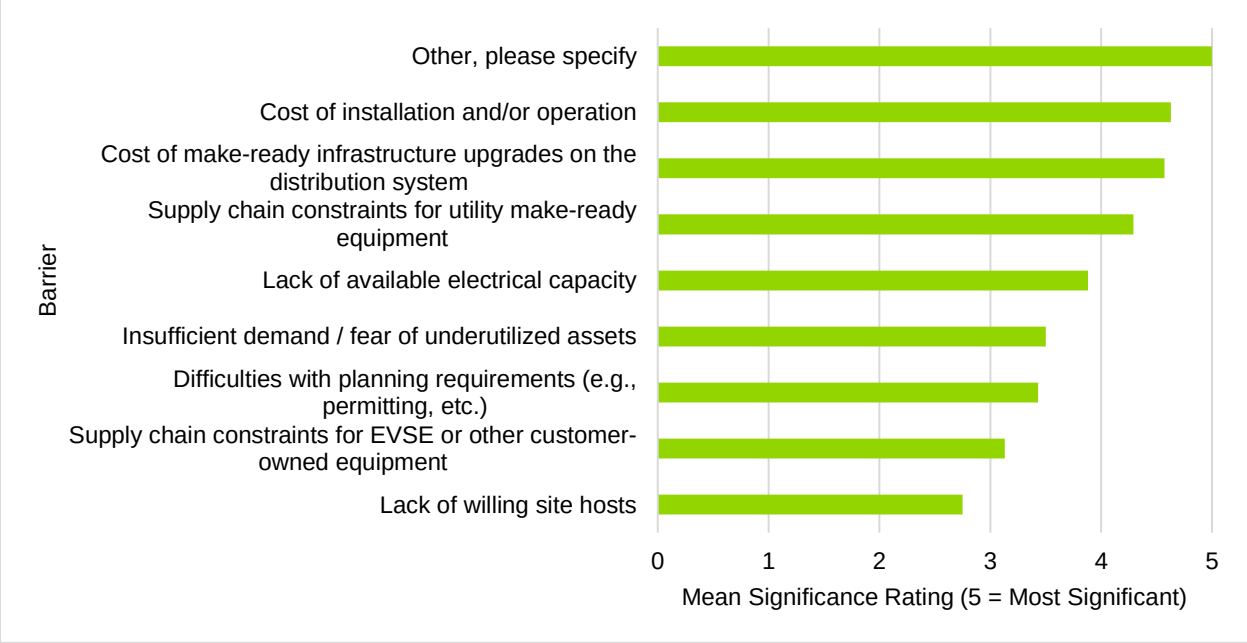
- **Inconsistent approach to scope of work, line extension costs**
  Nearly 50% of respondents indicated that a large hurdle in Ontario is a lack of consistency in how different LDCs approach line extension costs, or more generally, approach the scope of work for site costs. Respondents said there was variability in requirements, in processes, in eligibility for cost sharing, and more. Respondents noted that this lack of consistency leads to increased complexity for the provider.

- **High costs and/or lack of public investment support**
  Many respondents indicated that a significant barrier for further EV supply equipment connection in Ontario is the high costs associated with installation. Some respondents indicated that specific use cases (such as multi-unit dwellings or low utilization/remote sites) are not cost effective without public investment support. Others indicated that high operating costs, such as demand charges, can harm the business case for deployment. Other costs mentioned include high costs of land.

- **Miscellaneous**
  Other issues identified by respondents included lack of cost certainty for customers, lack of available electrical capacity at buildings, and uncertainty in key LDC contacts (who to contact for what?). One respondent indicated that bidirectional chargers face their own set of obstacles in Ontario, including inability to monetize benefits, unknown timelines, and variability in costs between buildings.

As a follow-up, respondents were asked to rank the significance of a series of barriers to the connection of EV charging infrastructure. In this system, a score of 1 represented an "Insignificant Barrier", while a score of 5 represented a "Very Significant Barrier". The below figure provides the mean ranking of the barriers as provided by the entire respondent pool. Responses of "Other" included lack of provincial funding, lack of consistency among LDCs, and lack of support for vehicle-to-grid initiatives / technology.

Figure 3-18 Barriers to Connection by Significance



Respondents, on average, indicated that the most significant barriers include the cost of installation and/or operation of EV charging stations, the cost of make-ready infrastructure upgrades, and supply chain constraints for LDC make-ready infrastructure.

Next, respondents were asked to indicate what information they require from LDCs, and at what stage of the project development process they need it, to evaluate where to deploy charging infrastructure. The most indicated responses are summarized below.

Early stages (planning):

- Access to detailed connection plans
- Cost sharing formula for infrastructure investments
- Location and specifications of equipment (e.g., power lines in the area and their voltage)

- Power availability and capacity across electrical system and at site

Prior to construction kickoff:

- Key contacts for requests
- Lead times for infrastructure, other supply chain constraints
- Timeline for connection based on current pipeline

Throughout entire lifecycle:

- Collection of data to identify underserved areas or areas of high demand
- Educational content and resources for customers

3.2.4 Interaction with Local Distribution Companies

A widescale rollout of public EV charging infrastructure will require collaboration from many parties: governments, EV charging service providers, LDCs, and many more. This survey sought input from two of those parties (the LDCs and charging service providers). To understand this relationship further, and to identify current pain points in their communication channels, EV charging service providers were asked to identify the primary challenges they face while deploying charging infrastructure, when working with LDCs after a site has been selected. The challenges identified by respondents can be grouped into the below categories:

Lack of communication:
Several respondents indicated that a lack of communication from representatives at LDCs was a recurring issue. Some respondents indicated they had difficulty reaching an appropriate contact at the LDC, and others stated they had difficulty getting timely responses or answers to questions. Respondents cited specific instances related to a lack of information about lead times and/or connection timelines, and multiple respondents indicated that a lack of communication can jeopardize site financials, as many installations rely on grant funding and/or other funding sources which have a defined application timeline.

Lack of flexibility:
Respondents indicated that the LDCs they have worked with can be very rigid within their processes, which can cause barriers for charging site installations that may vary site-to-site. Firstly, respondents cited a challenge with utilities is rigidity in their legal agreements; the arrangement of some charging sites may require a multi-lateral structure between tenants, site hosts, and charging service providers, which LDCs may not accommodate easily. Another challenge with regards to flexibility is in contractor selection – respondents indicated that some utilities require specific contractors to complete work. Lastly, as EV charging technology evolves, utilities may need to adapt to new charging standards. One respondent indicated that many utilities do not offer a 480V service, which may be required for future DC fast charging installations.[11]

[11] EV charging stations are classified by level, based on their input voltage. Input voltage is the amount of voltage a charging station requires to operate. Many homes are wired to include a 120V or 240V service. However, DC fast charging infrastructure requires an input voltage of at least 480V to operate.

Lack of consistency:
The final challenge, indicated by multiple respondents, is a lack of consistency across utilities in the province. Charging service providers must navigate different processes LDC to LDC, including a lack of clarity on cost-sharing methodologies (who pays for what?), and unpredictability in costs.

As a follow-up, charging service providers were asked if they had any suggestions, they'd recommend to address these challenges. Suggestions from respondents included:

- Providing a directory of contacts at each LDC for EV connections
- Providing innovative rate designs to address cost uncertainties
- Providing publicly available distribution load mapping
- Providing regular communication about supply chain constraints and other time-sensitive factors (such as in a monthly or quarterly publication)
- Standardizing formulas for make-ready cost sharing
- Standardizing the approach to EV connection requests
- Standardizing the scope of work for installations, with some recommending the OEB specify which costs should be covered by which party

3.2.5 Demand Charges

Demand charges are an element of some commercial and industrial electric service rates, wherein customers are charged for the peak amount of power (kW) that they consumed in their billing cycle. Demand charges, however, may impose challenges upon EV charging station providers, particularly Direct Current Fast Charging (DCFC) stations, which may have extremely high-power capacity but low volumetric energy consumption.

In the survey, charging service providers unanimously agreed they were concerned with the impact of demand charges on future EV supply equipment deployment, with three respondents stating they were 'Concerned', and five respondents indicating they were 'Highly Concerned'. In some instances, the ability to control / curtail customer charging, known as smart charging or managed charging, can help reduce demand charges, but not all stations on market are capable of this process. In the survey, 87.5% of respondents indicated their charging stations include methods to control EV charging behaviour.

A potential impact of installing EV charging stations is the increase in customer load resulting in the escalation of the customer to a different rate class (through increased peak demand). This may be a deterrent for customers to install EV charging stations at their facilities. Of the charging provider respondents surveyed, 50% were aware of instances where this has occurred, with the majority of those respondents stating this happens "often".

3.2.6 EV Adoption in Ontario

EVs represent a variable market share jurisdiction to jurisdiction – some jurisdictions have seen immense EV adoption to date, while others remain at an extremely early stage of adoption. Potential causes for this discrepancy include differences in regulatory barriers, differences in processes for installations, consumer preferences, and other variable factors. Recognizing that

many of the respondents in this survey have experience installing EV charging stations in regions outside of Ontario, Guidehouse asked respondents to comment on their awareness of alternate jurisdictions where processes and requirements for installations are more conducive to the deployment of EV charging infrastructure. Responses were, as expected, varied across participants.

Three different respondents cited the progress that has been made in California, a leading state for EV adoption. Firstly, the EV Infrastructure Rules, issued by the California Public Utilities Commission (CPUC) in 2021, were cited on more than one occasion.[12] These rules apply to separately metered EV charging facilities, excluding single-family homes, and aim to help utilities recover most of the costs associated with upgrades for EV charging installations. Respondents stated that the benefits of these rules include: cost recovery through general rate cases on a rolling basis rather than through sequential proceedings, the reduction of deployment timelines, and increased certainty in costs associated with investments. Secondly, one respondent cited the achievable potential of vehicle-to-grid integration and the CPUC's mandate for utilities to develop plans / approve funding for pilot programs associated with vehicle-to-grid integration and initiatives. Lastly, California's standardization of interconnection requirements was stated as a benefit for deployment.

Other jurisdictions with favourable characteristics for deployment referenced by survey respondents include Quebec, British Columbia, New York, and Massachusetts. In Quebec and British Columbia, respondents cited greater certainty about charger utilization (improving business case for investing in charging sites) due to their adoption of zero emission vehicle sales mandates. In Massachusetts, laws addressing EV charging rates were cited as beneficial to adoption by more than one respondent, including their standardized formula to cost recovery.[13] Many jurisdictions with alternative rate structures which can be beneficial to EV adoption were cited, including New York, Quebec, and Massachusetts. Lastly, two different respondents stated Alberta (ATCO) provides strong transparency on which costs are covered by which party, reducing uncertainty in planning.

Improvements in EV charging deployment can also come from increased communication and collaboration with electric utilities. Respondents were asked what information LDCs can provide to EV charging service providers to aid in their planning processes. Answers were varied, but included:

- Aggregated time-of-use profiles by customer class or use case
- Advanced notice of sites, power capacity requirements, load information, deployment schedules, etc.
- Historical example of site usage profiles

One respondent also indicated that LDCs currently apply an inconsistent approach to line extension costs and general scopes of work, increasing complexity and delays in projects, and recommended streamlining the interconnection process through a codified and standard scope of work, transparent approaches to cost assignment and a consistent mechanism for cost recovery.

[12] https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/transportation-electrification

[13] https://lpdd.org/resources/massachusetts-law-assessing-ev-charging-rates/

4. Key Takeaways from Survey Responses

This initiative sought to inform actions the OEB may take to ensure that EVs and EV charging infrastructure can be efficiently integrated with Ontario's electricity system. The previous sections of this report outlined barriers towards deployment of EV charging infrastructure, as identified by Ontario's LDCs and EV charging service providers.

Guidehouse has summarized the barriers identified by the survey respondents and consolidated the feedback below:

1. **LDC respondents reported that many of their organizations did not have a public guide in relation to the connection of EV chargers to the distribution system.** Most LDCs currently do not have a publicly available guide or process for the connection of EV chargers. Most utilities have designated staff for guiding customers through the connection process for EV charger deployments.

2. **LDC respondents reported a desire to improve their visibility of EV connections and their ability to forecast EV demand**. Currently, LDCs use a combination of in-house data and third-party forecasts, but these forecasts need to be adjusted to represent unique characteristics within each service territory. This takes up significant time for an LDC.

3. **LDC respondents reported a lack of clear guidelines to follow when bringing forth a business case related to investments for EV integration.** Some LDCs are currently not confident when it comes to bringing forth a business case related to investments associated with incorporating EVs. They report facing uncertainty around regulatory standards and cost evaluation methodologies when it comes to taking on these investments.

4. **LDC respondents reported that common requirements to enable managed charging and vehicle-to-grid integration may be required in the future.** A majority of LDC respondents reported that they had not published technical requirements for managed charging, although most of these LDCs noted these technical requirements may be needed in the near future. A majority of LDCs also reported interest in managed charging programs.

5. **LDC respondents reported a lack of clarity on rate-recoverable investments.** Respondents of the survey indicated a strong interest in eventually rate-basing investments in EV charging programs. They would also like support and direction on proactively investing in system upgrades and require clarification on the different funding mechanisms that are currently available to them.

6. **EV charging service providers reported a lack of clarity and consistency related to expected cost sharing formulas, roles, and responsibilities for EV infrastructure developments, together with concerns related to high upfront costs.** For EV charging service providers, the most identified barrier for deployment of charging infrastructure was high costs, and a lack of consistency across LDCs in Ontario regarding cost-sharing formulas, and approaches to scope of work. The result of this inconsistency is a lack of clarity for service providers when planning future deployments – when doing business planning and budgeting, charging service providers are left

without answers to crucial questions such as “What elements of the installation will we be paying for?” and “How will we know how much of the line extension cost will be covered by the LDC?”. This creates an unnecessary level of complexity in the province and may deter future deployments when compared to other jurisdictions. Respondents cited success in other jurisdictions, such as ATCO in Alberta, as an example to look to.

7. **EV charging service providers reported a desire to explore alternative rate structures to address demand charges for DC fast charging infrastructure with low utilization.** When the charging service providers were asked to rank the significance of barriers for future charging infrastructure deployment, high installation and/or operating costs were identified as the most significant hurdle. Due to the often low utilization of public charging infrastructure, and the unpredictability of charging events, the current demand charge structure in Ontario can represent a disproportionately large cost for site hosts.

8. **EV charging service providers reported a lack of streamlined communication between LDCs and EV charging service providers.** Successful and efficient deployment of EV charging infrastructure necessitates effective collaboration and communication between EV charging service providers and LDCs. There is a plethora of information and data that must be exchanged across the deployment process, which oftentimes requires a timely response (e.g., requirement of information to complete a grant application with a short window). EV charging service providers indicated that a lack of communication is currently a barrier towards further deployment – these parties have indicated that they often do not know who the correct contact at the LDC is, and once they’ve identified that contact, may experience delays.

9. **EV charging service providers reported challenges in obtaining information to aid in planning and development.** EV charging service providers reported a need for timely access to information related to available distribution system capacity, site layouts to aid in design, and information related to achievable timelines for make-ready works.

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