Executive Summary:

From Plug to Power: EV Charging Infrastructure and Grid Readiness in Ontario

Assessing Infrastructure, Grid Capacity, and Policy Pathways for Ontario's Electric Mobility Future

Quarterly Specialized Report

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Executive Summary

Ontario plays a pivotal strategic role in shaping the future of electric vehicle (EV) charging infrastructure, not only within Canada but as a global leader in smart grid integration and clean transportation innovation. The province's electricity demand from EVs is projected to grow from 2.33 TWh in 2026 to 41.75 TWh by 2050, representing nearly 16% of total electricity demand. This dramatic increase underscores the urgency of coordinated planning, capacity expansion, and technological innovation to support the transition.

With its robust policy frameworks, advanced digital infrastructure, and proactive investment in grid modernization, Ontario is setting standards for how jurisdictions can transition to electrified mobility while maintaining grid reliability, equity, and economic growth. The province's leadership is evident in its deployment of smart meters, support for distributed energy resources (DERs), and pioneering work in vehicle-to-grid (V2G) technologies, positioning it at the forefront of the energy transition.

The province's smart grid capabilities are a cornerstone of its EV strategy. Ontario has nearly universal deployment of smart meters and advanced metering infrastructure (AMI), enabling real-time energy management and integration of DERs such as rooftop solar and battery storage. Technologies like distributed energy resource management systems (DERMS) and virtual power plants (VPPs) allow utilities to treat EVs and other distributed assets as flexible grid resources. Artificial Intelligence (AI)-driven predictive analytics are being used to forecast EV charging impacts and optimize load management, while Storage-as-a-Service (SaaS) models are leveraging second-life EV batteries to defer costly infrastructure upgrades.

Ontario's regulatory framework supports the transition through initiatives like the Electric Vehicle Charging Connection Procedure (EVCCP), which standardizes utility connection procedures, and federal programs such as the Zero Emission Vehicle Infrastructure Program (ZEVIP) and the Clean Electricity Regulations. Currently, Ontario has a significant concentration of chargers in urban areas. Regional disparities persist, particularly in northern and rural communities, but initiatives like the Ivy Charging Network and the EV ChargeON program are helping to bridge these gaps. Grid bottlenecks, including overloaded transformers and constrained feeders, pose challenges to further expansion, underscoring the need for strategic planning and investment.

Ontario's charging infrastructure is divided between public and private networks. Public chargers, especially Level 2 units, are concentrated in urban areas and along highways, while private charging – primarily at homes – accounts for approximately 80% of EV usage. However, access to home charging is not universal, particularly in multi-unit residential buildings (MURBs), prompting the need for expanded public infrastructure and targeted policy support.

Load management is critical to grid stability as EV adoption accelerates. Ontario employs time-of-use (TOU) and ultra-low overnight (ULO) pricing to incentivize off-peak charging. Managed charging pilots have demonstrated significant reductions in peak demand, and Vehicle-to-Everything (V2X) technologies – including V2G, Vehicle-to-Home (V2H), and Vehicle-to-Building (V2B) – are proving technically and economically viable. These innovations allow EVs to discharge electricity back into the grid or buildings, enhancing resilience and offering new revenue streams for owners.

Environmental and social equity considerations are central to EV strategies, including Ontario's. EV charging infrastructure reduces emissions and health risks associated with petrol stations, and equitable access is being addressed through initiatives like the EV ChargeON program and universal design standards. Global best practices, such as California's Equitable EV Charging Act and Norway's "right to charge" policy, offer insights for Ontario to consider. Community-based planning and inclusive design are essential to ensuring accessibility for all users.

This trajectory of rising demand necessitates capacity expansion, distribution system upgrades, smart charging coordination, and robust supply chains. Initiatives such as OVIN's R&D Partnership Fund – Advanced Charging and V2G Stream – are looking to the future of technology to support innovation and efficiency. Additional key opportunities for Ontario to meet demand include expanding access in MURBs, strengthening rural and remote networks, integrating smart charging and V2G technologies, streamlining permitting processes, and enabling market participation for aggregated EVs. Data transparency and consumer confidence are also areas of opportunity, with reliable and user-friendly charging experiences essential to accelerating adoption. By leveraging its existing strengths and addressing current challenges, Ontario is well-positioned to lead the transition to a clean, electrified transportation future.

This report provides a comprehensive analysis of the current state and future projections of EV charging infrastructure in Ontario through research and expert interviews. It examines the readiness of the electrical grid to support the increasing demand for EV charging, highlighting key challenges and opportunities. The report covers various aspects such as technological advancements, policy and regulatory frameworks, market trends, and the impact on grid stability and energy consumption. Additionally, it offers opportunities for Ontario to enhance infrastructure development and ensure a smooth transition to a more sustainable transportation system.

> "By expanding access to charging infrastructure beyond urban centres, we're ensuring workers and families across the province can feel confident in their adoption of EVs."
>
> – The Honourable Victor Fedeli, Minister of Economic Development, Job Creation and Trade

1. The EV Charging Landscape

As EVs become more common on our roads, the systems that power them are quickly evolving. From the different types of chargers available, to new technologies that aim to make charging quicker and smarter, like smart charging, dynamic charging, and battery swapping, the landscape is adapting to meet user and operational needs. Both public and private charging networks require specific considerations to meet the needs of typical users and are expanding to keep pace with demand. Considerations about improving user experience and optimizing electricity use remain important to EV charging development and growth, and factors like accessibility, availability, and reliability remain critical to consumer confidence and continued adoption. Technological and infrastructure innovations, changing user needs, and grid considerations are shaping the future of EV charging.

1.1 EV Charger Fundamentals

EV charging infrastructure comes in varied forms suited to different needs and environments. Chargers are classified into three main categories: Level 1, Level 2, and Level 3. EV chargers are either alternating current (AC) or direct current (DC), with AC typically used for slower charging and DC for faster charging.

Level 1

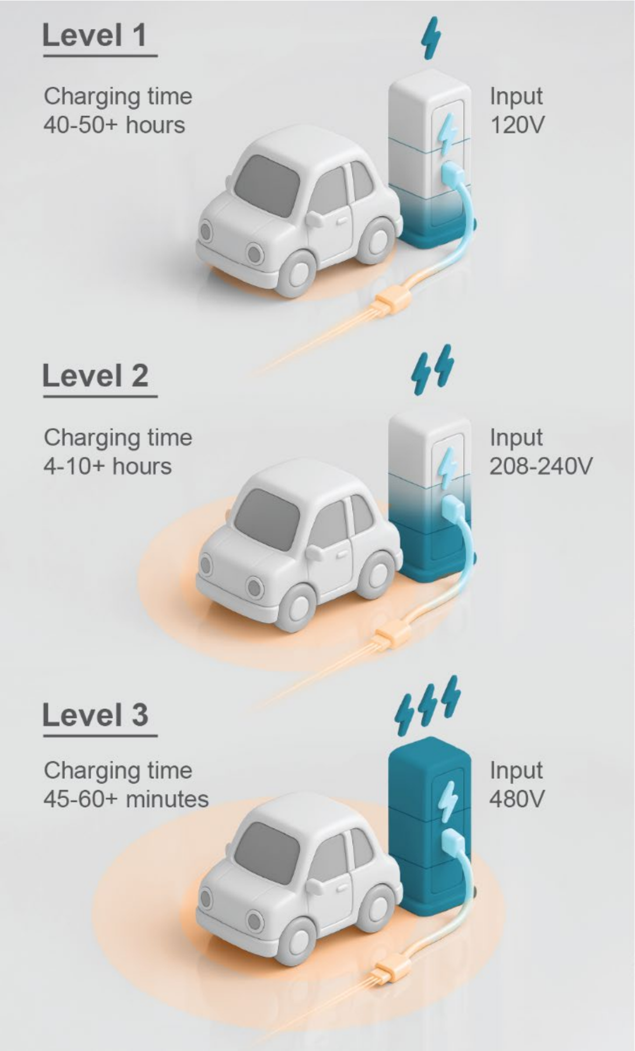
Level 1 is the most basic and slowest method of charging an EV. It uses a standard household outlet and requires 40-50+ hours to fully charge a Battery Electric Vehicle (BEV), and about 5-6 hours for a Plug-in Hybrid Electric Vehicle (PHEV). While Level 1 charging is not ideal for fully recharging BEVs quickly, it is sufficient to fully recharge most PHEVs overnight and is an effective option for lower mileage and less vehicle-dependent drivers.

Level 2

Level 2 is the most common way to charge. It is a faster and more powerful form of AC charging and is installed by a licensed electrical contractor, often in commercial and residential settings. Level 2 can take between 4-10 hours to fully charge a BEV and just 1-2 hours to fully charge a PHEV. Level 2 is typical for public charging and is often referred to as "destination" or "opportunity" charging as it is useful in locations where vehicles remain parked for several hours or are looking for a quick top-up.

Level 3

Level 3 charging, or DC fast charging, is the quickest and most powerful charger, delivering DC power directly to the battery. Level 3 chargers are generally used by BEVs and can typically recharge in about 45-60 minutes. These stations require professional installation and are significantly more expensive. Not all EVs are compatible with all Level 3 chargers. Current standards for Level 3 charging include the North American Charging System (NACS or SAE J3400), CHarge de MOve (CHAdeMO), and the Combined Charging System Version 2 (CCS-2).



1.2 Emerging Charging Technologies

There are also several emergent EV charging technologies which are currently being explored and have the potential to transform the market. These are described below:

Smart charging: Smart chargers are internet-connected and remotely accessible, enabling scheduled charging that aligns with grid capacity and pricing signals, allowing EV owners to optimize charging times for cost savings, while also providing valuable demand-side flexibility for grid operators. Beyond grid benefits, smart charging supports battery health by managing charging rates to prevent overcharging and overheating, which can degrade battery performance over time.

Dynamic charging: Dynamic charging, which takes place while vehicles are moving, is also being explored. This can be achieved through conductive methods, such as overhead catenary lines commonly used in trams and light rail, or through inductive wireless charging.

Battery swapping: An emerging solution that enables the quick replacement of depleted EV batteries with fully charged ones, offering convenience like refuelling at gas stations. It can reduce upfront EV costs, extend battery life through professional handling, ease pressure on electricity grids, and support circular economy goals through centralized reuse and recycling.

1.3 Charging Network Characteristics

Deployment strategies for public charging vary by country and city, and are shaped by factors such as population density, home charging availability, and road network design.

Public Networks

Public charging networks consist of two primary types of infrastructure: Level 2 and Level 3 chargers. Most public chargers are slower Level 2 units and located in urban areas. Highway chargers are typically fewer in number but are generally Level 3, meaning they contribute a larger share of total charging capacity due to their higher power output.

Private Networks

Private charging remains the dominant method for EV users, with around 80% of charging in Canada occurring at home, typically overnight. While public charging infrastructure is essential, particularly for MURB dwellers and long-distance travel, it is used less frequently for daily driving. However, access to home charging is not universal. Many residents in multifamily housing face barriers to installing chargers unless buildings are retrofitted or new developments are made EV-ready. In such cases, urban public charging becomes a vital substitute. Additionally, private charging infrastructure is critical for medium- and heavy-duty vehicles, especially in early market stages. This includes overnight depot charging and opportunity charging at destinations like warehouses.

1.4 Energy Utilization and User Experience

As EV adoption accelerates, the performance and usability of charging infrastructure becomes increasingly important. Beyond availability, how efficiently chargers are used and how reliably they serve drivers are key indicators of a well-functioning system. Factors such as energy utilization rates, charger reliability, wait times, and accessibility all contribute to the overall user experience and influence public confidence in EV charging networks. Utilization of EV charging infrastructure is shaped both by infrastructure capacity and user behaviour. In the early stages of EV adoption, infrastructure capacity may outpace demand, leading to low utilization rates. As adoption accelerates and the market matures, usage becomes more efficient and better aligned to demand. However, this growing electricity consumption, particularly during peak hours, can place significant strain on the grid. To address these challenges, emerging solutions and technologies are expected to play a critical role by optimizing when and how EVs draw power, helping to balance grid loads and enhance overall efficiency.

As utilization and availability grows, it is also important to consider user experience, which is deeply influenced by access and reliability. Availability alone does not guarantee access. Many public chargers are classified as "semi-public," meaning they are only accessible to certain groups, such as hotel or supermarket customers, or may be restricted by limited operating hours. Even fully public chargers can present usability challenges due to incompatible plug types, restrictive payment systems, or brand-specific limitations. Improving user experience requires more than expanding infrastructure, it demands standardization, dependable performance, and transparent access to real-time data on charger availability and pricing. These elements are essential to making public charging infrastructure truly accessible and user-friendly.

Charger uptime is also crucial user experience metric as charging can only occur when equipment is operational. A report commissioned by Natural Resources Canada revealed that in January 2022, 6% of Level 2 and 5% of Level 3 chargers were offline, while 7% of Level 2 and 11% of Level 3 charging sessions failed, lasting less than five minutes. These issues led to an average user satisfaction rating of just 3.6 out of 5, underscoring how technical reliability directly affects driver confidence and satisfaction.

2. Grid Readiness: Capacity, Flexibility, and Constraints

Across Canada and internationally, jurisdictions are investing in smart grid technologies and digital infrastructure to support the integration of EVs into modern electricity systems. Innovations like smart grids – featuring real-time monitoring, automation, and two-way communication – are enabling more efficient energy management and facilitate large-scale EV adoption. Paired with other technologies such as smart meters, AI, Distributed Energy Resource Management Systems (DERMS), and emerging models like Storage-as-a-Service (SaaS) and Virtual Power Plant (VPPs), the industry continues to evolve to meet growing electricity demands, improve grid resilience, and adapt to key challenges.

2.1 Smart Grid Integration and Digital Infrastructure

As the global EV market matures, more regions are integrating EVs into modern, intelligent electricity grids. These efforts are supported by growing investments in smart grid technologies and digital infrastructure that enable real-time energy management, enhance grid reliability, and support the transition to cleaner transportation systems.

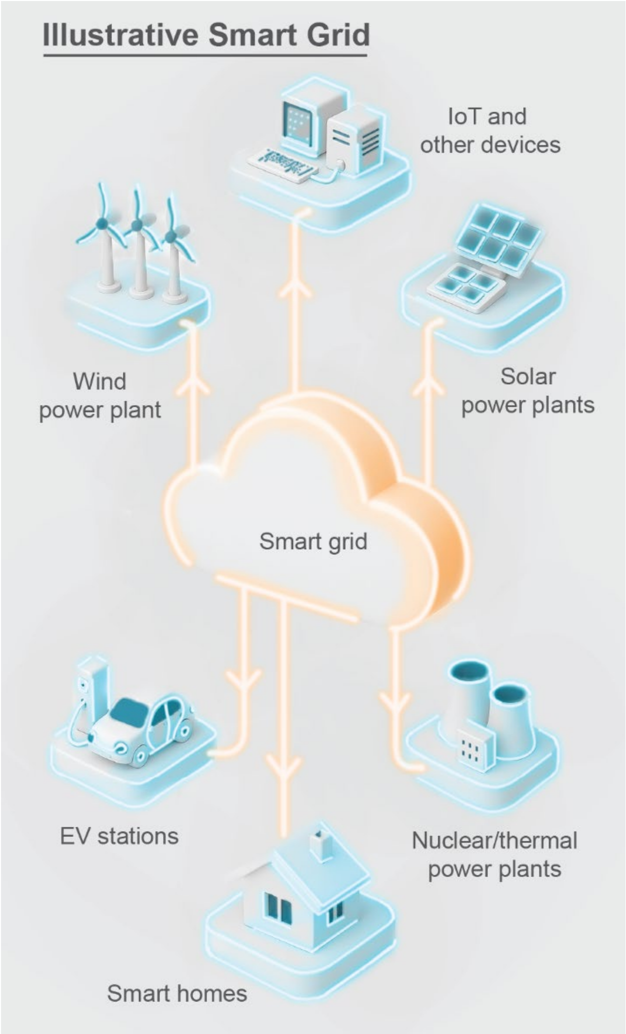
Smart Grids

A smart grid refers to an electricity network enhanced with digital communication and automation technologies, allowing for two-way data flow between utilities and the consumer, which includes groups like renewable power generators, homeowners, and EV users. This infrastructure enables real-time monitoring, adaptive control, and efficient management of electricity demand across an entire ecosystem, which is particularly key for supporting the large-scale integration of EVs.

Globally, smart grids are gaining prominence as jurisdictions aim to modernize aging infrastructure and respond to increasingly dynamic energy loads including EVs. By 2030, smart meters, a digital device that records electricity usage in real-time and communicates with utilities, are expected to be deployed in over 80% of global households.

Advanced Metering and Predictive Analytics

Advanced metering systems, when integrated into centralized data repositories, can unlock predictive analytics that are critical for long-term grid planning. By analyzing consumption patterns, utilities can identify trends in EV adoption, forecast localized impacts, and implement targeted interventions before bottlenecks arise.

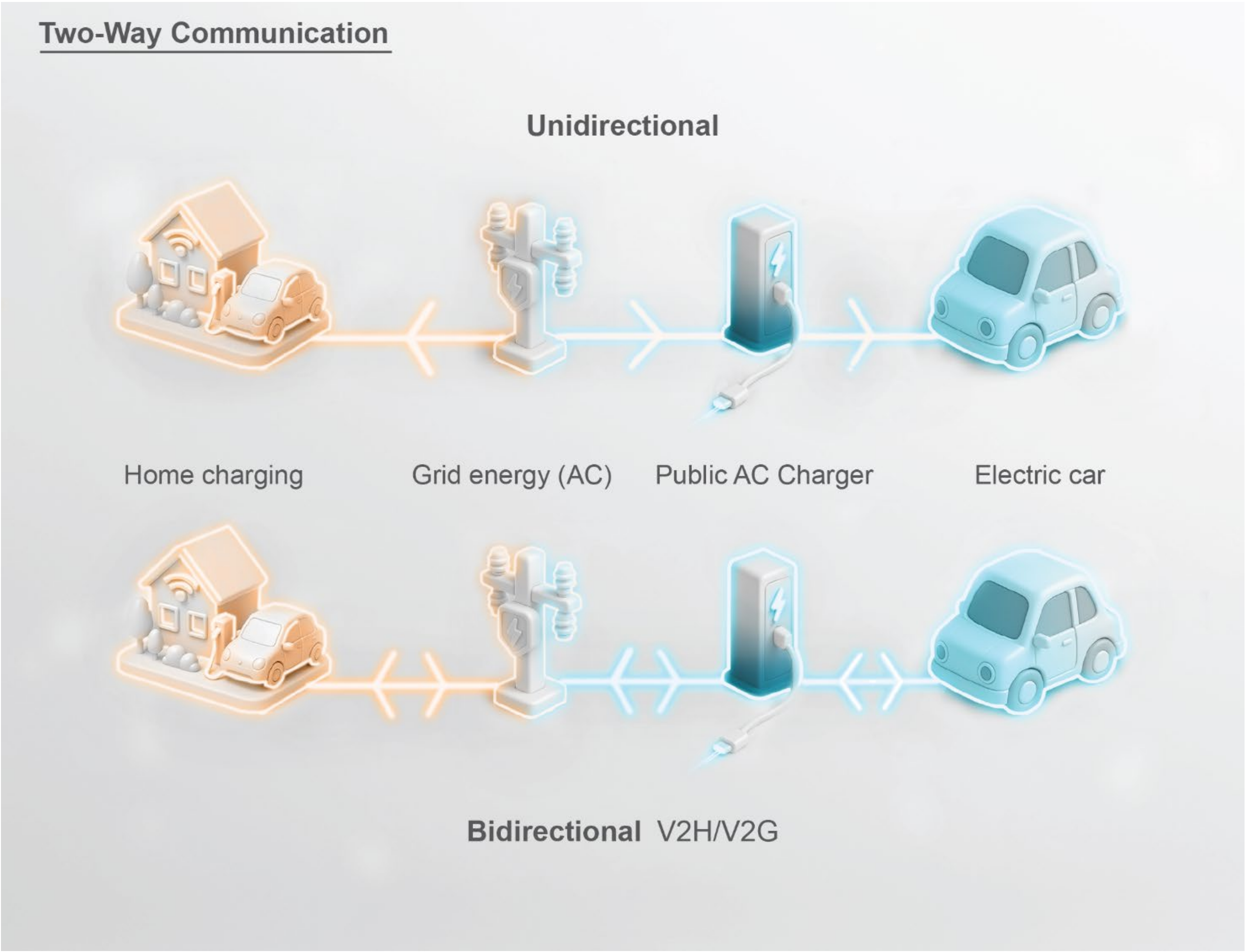


Two-Way Communication and AI for Load Balancing

Two-way communication within the grid allows devices such as EV chargers to not only draw electricity but also respond to grid signals such as requests to pause or shift charging during periods of high demand. When combined with technologies like AI, these systems can forecast peak load times, optimize energy dispatch, and balance supply and demand in real time.

Digital Tools and Software Platforms

To effectively manage EVs as grid resources, utilities and service providers are increasingly deploying advanced software platforms known as DERMS. These tools aggregate and control various distributed resources including EVs, batteries, and rooftop solar systems, essentially treating them as flexible, dispatchable assets. When integrated with grid operations or electricity markets, these aggregated systems function as VPPs, capable of providing services akin to a conventional power plant. Globally, VPPs are rapidly gaining traction, helping to stabilize grids and reduce emissions.



Storage-as-a-Service

SaaS models allow battery storage to be offered as a flexible utility service rather than a fixed, customer-owned asset. These arrangements enable third-party providers to install and operate batteries that utilities or building owners can "rent" to manage demand peaks or support EV charging. A growing area within this model involves the reuse of EV batteries, which typically retain around 70-80% of their capacity after vehicle retirement and can serve secondary functions in stationary applications.

2.2 Distributed Energy Resources and Storage Supporting EV Integration

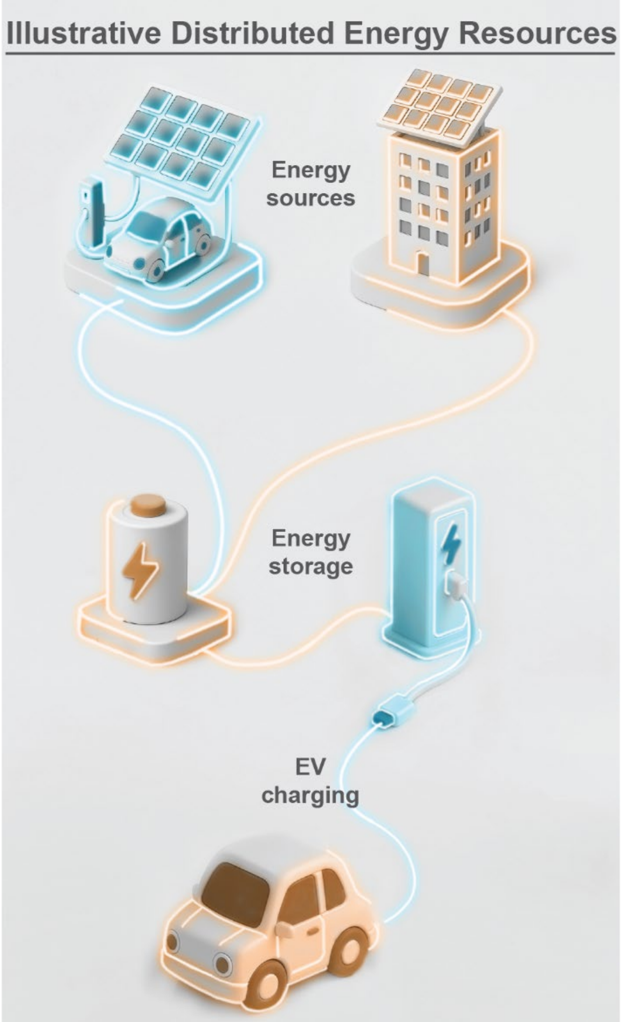
As EVs become more common, the pressure on the grid is expected to rise, especially during peak hours when many drivers and other power users plug in at once. This has prompted jurisdictions to look for innovative ways such as DERs and energy storage to ensure that the trend towards greater EV adoption does not face systemic, grid-related headwinds.

DERs and Behind-the-Meter Generation

DERs, such as rooftop solar, small wind turbines, behind-the-meter (BTM) batteries, and community scale microgrids offer localized energy that can directly support EV charging while reducing strain on the broader electricity system. Paired with intelligent software and storage technologies, these systems can shift, smoothen, and even reverse electricity flow, making EVs not just consumers of electricity but contributors to grid resilience. Globally, BTM solar is now the fastest-growing source of renewable capacity. The International Energy Agency (IEA) projects that solar alone will supply about 80% of all new renewable energy growth between 2024 and 2030.

Battery Energy Storage Systems

A Battery Energy Storage System (BESS) is a stationary battery system that stores electricity for later use and can be used to help balance grid load while supporting EV charging. Grid-connected BESS absorb electricity when demand or prices are low and discharge it when the system is strained, providing the flexibility an EV-dominated transport system requires. Experts note that BESS can be an important technology for implementing renewable power. Experts note that solutions such as BESS can help with stabilizing demand on the grid, as unmanaged demand can require significant grid infrastructure



capital investment which could have otherwise been avoided.

2.3 Microgrids and Community-Scale Systems

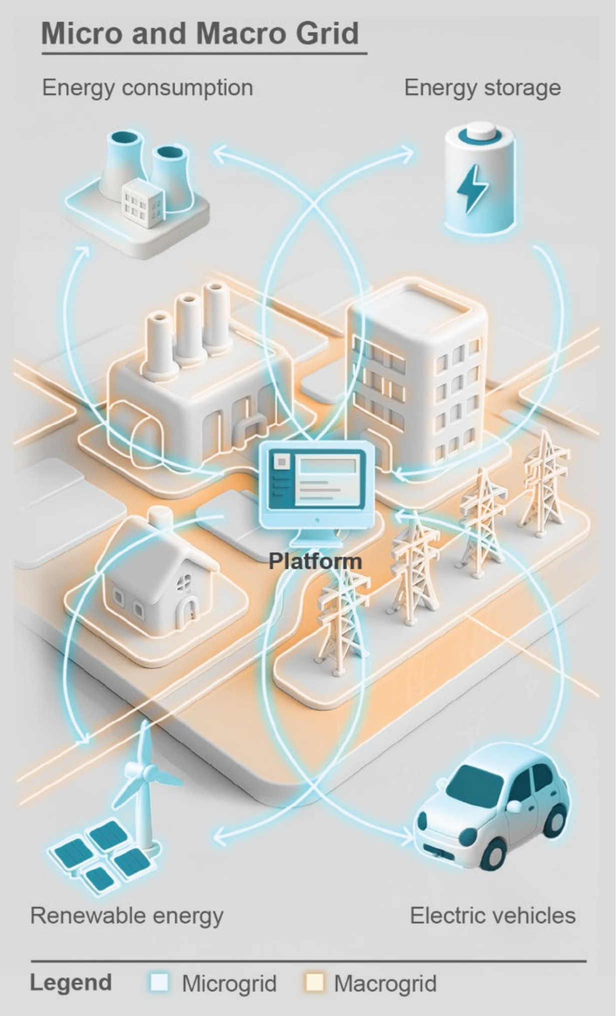
A microgrid is a local energy system that can operate independently or in coordination with the main grid. It often includes DERs, batteries, and smart controls, and can be thought of as a cluster of power loads. DERs can “island” from the main grid and run independently, especially during systemwide grid outages or natural disasters. Microgrids and EVs interact through two-way energy flow; EVs charge from the grid when power, especially renewable, is available, and can return energy during peak demand. Experts note that this exchange, managed by smart systems, balances supply and demand, boosts resilience, and supports clean energy use. Microgrids can manage energy without interacting or interfering with the grid, which provides the benefits of not burdening the grid during peak hours. These technologies are also significantly smaller financial investments compared to the grid infrastructure that would be otherwise required to meet demand.

2.4 Load Management and Optimization Strategies

As EV adoption accelerates, the timing and intensity of charging activity are critical factors in grid planning. Without intervention, clusters of EVs charging during peak evening hours could overwhelm local transformers and increase the need for costly infrastructure upgrades. Load management and optimization strategies aim to address this challenge by shaping how, when, and even in which direction electricity flows between vehicles and the grid.

Pricing Strategies

TOU pricing is a well-established method for influencing consumer behavior. It reflects the real cost of supplying electricity throughout the day, encouraging people to shift usage to times when the grid is under less stress. In contrast, ULO pricing offers significantly reduced rates during specific overnight hours to encourage electricity use when overall demand is lowest. Depending on the TOU and ULO rates, ULO can often be a more cost-effective measures for customers that use more electricity at night, like shift workers or those charging EVs at home overnight.



Managed Charging

While pricing provides broad behavioural guidance, managed charging enables utilities and operators to actively adjust EV charging rates or schedules in real-time. Experts note that this can help flatten peaks, stabilize voltage, and align charging with renewable energy availability.

Vehicle-to-Everything and Bidirectional Charging

Beyond one-way managed charging lies the emerging field of V2X technologies. These systems allow EVs to discharge electricity back into different end-uses, providing flexibility, resilience, and potential revenue streams. Experts have noted the value of these technologies in reducing grid infrastructure costs, supporting LDCs and transmission companies, providing flexibility for the grid, and providing additional opportunities for leveraging renewable energy generation like solar power.

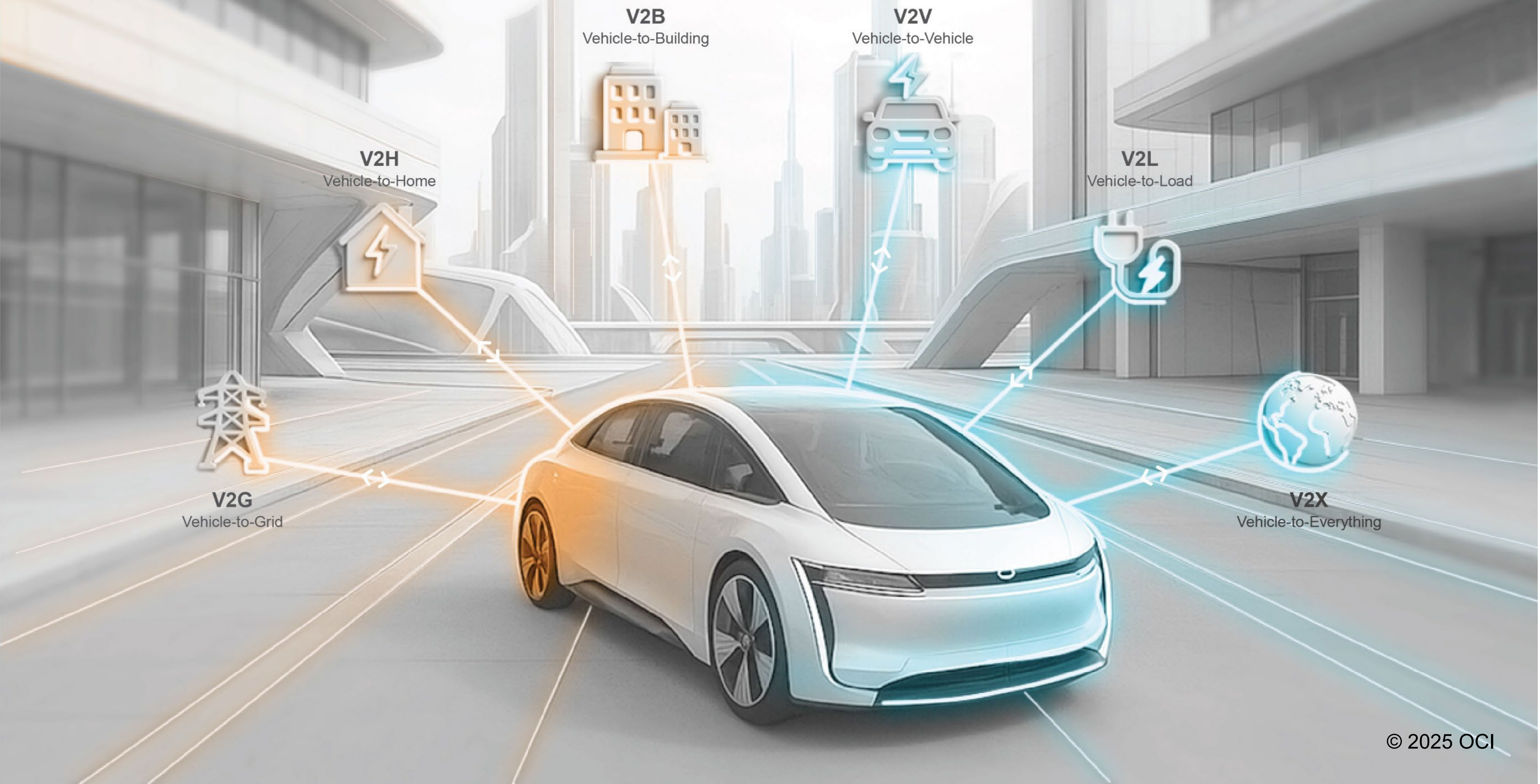
V2X includes several subcategories:

- **V2G (Vehicle-to-Grid Both Ways)**: This allows EVs to send stored energy back to the power grid during times of high demand.
- **V2B (Vehicle-to-Building)**: Parked EVs can supply electricity to a building during peak usage times or outages. The system ensures the vehicle still has enough charge for the driver's needs by the end of the day.
- **V2H (Vehicle-to-Home)**: Similar to V2B but on a smaller scale, this setup allows an EV to power a home, usually during event such as power outages, acting like a backup generator.
- **V2V (Vehicle-to-Vehicle)**: This enables one EV to transfer power directly to another, whether it is a car, truck, bus, scooter, or e-bike.
- **V2L (Vehicle-to-Load)**: Using built-in outlets and an inverter, an EV can power tools, appliances, or other plug-in devices, essentially turning the vehicle into a mobile power source.

"To meet soaring energy demands, we're working with communities to plan ahead and build for our future so that we can generate more power that is reliable and affordable for our families today and tomorrow."

– The Honourable Stephen Lecce, Minister of Energy and Mines

Towards Vehicle-to-Everything



2.5 Environmental and Social Benefits of Expanding EV Charging Infrastructure

Expanding EV charging infrastructure is key to increasing adoption and realizing the various environmental and social benefits like emissions reductions, improved health and safety compared to traditional gas stations, and maximized space. EV charging enables a more sustainable mode of transportation with less emissions and pollution, especially in locations where the grid's energy mix favours renewable energy. EV charging stations also do not include underground storage tanks, do not require the handling of hazardous materials, offering significant benefits to both the environment and health and safety.

Depending on their size and scope, EV charging stations can also require less space per vehicle than typical gas stations. Chargers can also often be more easily integrated into existing infrastructure like parking lots and structures; vehicles can even be charged using existing standard 120 volt outlets. Like gas stations, EV charging stations still require planning and diligence to ensure installation does not adversely impact habitats or disrupt ecosystems.

Regulating Equity and Accessibility

As EV adoption continues to grow in jurisdictions across the globe, so does the need for safe, reliable, accessible, and affordable charging infrastructure. Different countries and cities have adopted varied strategies for deploying public charging stations, depending on factors such as population distribution, access to home charging, and the state of road networks. Equitable EV charging deployment is a significant topic as it is critical to consider how such long-term investments can provide equality of access and consider diverse needs and support underrepresented communities.

Universal design – a recognized approach to creating environments that are accessible, understood, and used by all people regardless of age, size, ability, or disability – is another critical element of equity as many EV charging stations are not designed with these principles in mind. Considering diverse needs also includes pricing transparency and ensuring systems are user-friendly.

Community Planning and Engagement

Depending on the initiative, EV charging expansion can benefit communities in an intentional and considered manor. There are several forms of EV infrastructure planning: corridor-level for facilitating inter-regional travel, site-level for focusing on pre-determined locations, and community-level to meet the diverse needs within a region or municipality. Community-level planning engages stakeholders with a key focus on understanding local need and considering different perspectives across planning process. These efforts offer future-focused thinking that can incorporate the unique factors of the areas considered. This approach offers benefits such as striving for a unified user experience, focus on minimizing barriers to access, increased reliability, and lower risk of asset stranding. Community-based decision-making can also allow community members to have a voice in their local areas and enable considerations on how to mitigate common issues such as inequitable access and unintended traffic increases.

Adapting Workforce

The transition to lower carbon transportation means new jobs and skills in areas such as EV and vehicle parts manufacturing and maintenance and repairs. There are also new workforce opportunities afforded with expanding EV charging infrastructure. This includes roles in construction, electrical, engineering, planning, and management – implementing and operating EV charging infrastructure requires equipment operators, electricians, repair technicians, electrical engineers, civil engineers, structural engineers, surveyors, estimators, construction managers, and site acquisition agents. With this, one estimation found that Canada will need approximately 3.5K full-time positions by 2035 to specifically meet projected EV charging needs, with demand for labour ramping quickly. Job growth is also expected from final assembly due to domestic production.

2.6 Key Challenges

Grid Sizing and Utilization

Electric grids are traditionally built to meet peak demand, such as hot summer days, leaving much of their capacity underused during off-peak times. This average usage, or load factor, reflects how efficiently the grid is utilized. As electrification grows through transition efforts such as EVs and heat pumps, unmanaged demand could worsen peaks and strain capacity. However, with smart planning, new loads can be shifted to off-peak periods, improving grid efficiency.

Many regions face low utilization and rising peaks. For instance, uncontrolled EV charging can cause evening demand spikes, requiring costly upgrades even when overnight capacity is available. To address this, utilities and policymakers are adopting demand management tools like TOU pricing and smart charging to flatten the load curve.

Supply Chain Constraints

The global electrification boom, combined with pandemic-related disruptions, has strained supply chains for critical grid components. Transformers, switchgear, and high-power chargers are in high demand and short supply, leading to long lead times and rising prices. These components are essential. Shortages and delays in this hardware are slowing down grid expansions and electrification projects everywhere. Around the world, utilities and developers are reporting delays waiting for equipment. Lead times for new units have ballooned. For example, the delivery time for large high-voltage transformers is now three to five years, and their prices have nearly doubled since 2018. Similarly, switchgear has been backlogged; while the lead times have improved, they remain significantly higher than pre-COVID levels, affecting utilities and projects. Even EV charging hardware is affected: some high-power chargers have seen lead times grow from roughly eight weeks to over 30, due to semiconductor shortages and high demand.

Cyber Security Risks

As grid-related technologies continue to innovate, integrate, and digitize, cyber security remains a top concern for the industry. The modern North American grid spans across the continent, consisting of different technologies and organizations mandated with keeping power safe and reliable. Disruptions to the grid can critically impact public safety, national security, and the economy. Cyber threats across the world have risen significantly over the last decade. These actions typically target local distribution and bulk power system organizations with the intent on disrupting the larger system. Experts also point to ensuring that the smart systems themselves are secure against cyber threats and attacks. As the EV charging ecosystem becomes smarter and more integrated, it is essential to consider cyber security at many points and not simply with the grid. There are also challenges with data privacy when clear regulations on data generated from EV charging and smart grid infrastructure have not been implemented. It is critical for organizations across the industry to invest in cyber security to allow the sector to continue benefitting from improved and emerging technologies.

Interconnection Timelines

Connecting new sources of electricity or major new loads to the grid, the process known as grid interconnection, is often a slow and complex endeavor. This process involves impact studies, regulatory approvals, and often significant construction of lines or upgrades before power can flow. Even if generation projects or EV charging sites are ready to go, getting connected to the grid can take years. Lengthy interconnection queues are a widely reported problem as the energy transition accelerates. On average, across North America, it now takes about five years from the time a new power plant requests interconnection to when it achieves commercial operation.

Consumer Confidence

The road to EV adoption is not one without bends and bumps, challenges with consumer confidence in the evolving market continue to shape the transition across the EV ecosystem. Range and charging remain top consumer concerns around the world. McKinsey's annual global Mobility Consumer Pulse Survey offers insights into these issues, noting that the top consideration is longer available driving ranges. Many prospective buyers remain concerned with trips outside of their typical daily driving, including long road trips. The third and fourth highest considerations are the availability of charging stations and access to fast charging, respectively. Prospective buyers are looking for the same convenience as current gas stations offer, though value range more than charge time. Most people considering an EV agree that 30 minutes for full charging is sufficient, which is commonly achievable with Level 3 chargers. Other barriers include consumer perception that their daily routine must involve frequent recharging, which is not the case for most.

Customers also experience challenges with payment like failing credit card readers and poor network connectivity causing processing issues, too many payment options and unique interfaces increasing user confusion, and exposure to weather causing operational issues with card readers. Payment can also be an equity issue, as the height and angle of a card reader can create accessibility issues. Experts highlight recent traction in jurisdictions like Europe with EV roaming – the ability of an EV driver to seamlessly use public charging stations regardless of the operating charging network.

Many of the challenges with consumer confidence can be solved through increased education, though some remain more related to ensuring the appropriate infrastructure is available and standardized.

3. Regulatory Landscape of EV Charging Infrastructure

As commitments to phasing out internal combustion engine (ICE) vehicles grow, the spotlight has shifted to the readiness of electricity grids and the regulatory frameworks that govern them. Meeting EV adoption targets is no longer just a matter of vehicle supply – it hinges critically on the capacity, flexibility, and resilience of the power grid. Governments around the world are implementing policies that not only expand the availability of public charging stations but also ensure reliability, accessibility, interoperability, and integration with broader energy systems. Common themes include the need for standardization, transparent pricing, smart grid compatibility, and inclusive access. Together, these regulatory efforts are laying the foundation for a global EV ecosystem that is not only expansive but also equitable, efficient, and future-ready. This chapter first examines the global regulatory context and then reviews Canada's current landscape.

3.1 Global Regulatory Landscape

This section provides an overview of key regulatory approaches in leading markets – the United States, the EU, the UK, and China – highlighting how each jurisdiction is shaping its EV infrastructure to meet ambitious decarbonization and electrification goals.

United States

The United States has established a comprehensive EV charging regulatory and funding framework, primarily through the National Electric Vehicle Infrastructure (NEVI) Standards and Requirements and associated federal programs. Effective from February 2024, the NEVI Standards set forth a unified regulatory baseline for all publicly accessible EV charging stations funded through federal programs. These standards apply across all states, the District of Columbia, and Puerto Rico, and are intended to ensure a consistent and high-quality user experience nationwide.

The NEVI Formula Program allocates $5B over five years (2022-2026) to help states deploy EV charging infrastructure along designated Alternative Fuel Corridors (AFCs). This funding is aimed at creating a cohesive national network that supports long-distance EV travel and data-driven infrastructure planning. Complementing NEVI is the Charging and Fueling Infrastructure (CFI) Discretionary Grant Program, which provides an additional $2.5B for EV charging projects in both urban and rural areas, including those located along AFCs. Together, these programs represent a historic federal investment in EV infrastructure. The NEVI initiative is part of a broader federal strategy to modernize transportation and reduce greenhouse gas emissions. However, its implementation has faced political and administrative challenges. Notably, funding under NEVI and related programs has been subject to delays and reviews under the Unleashing American Energy Executive Order, which has temporarily paused certain disbursements and introduced new scrutiny over energy-related spending.

European Union

The EU has adopted a robust and binding regulatory framework to accelerate the deployment of alternative fuels infrastructure, with a particular focus on EV charging. The cornerstone of this framework is the Alternative Fuels Infrastructure Regulation (AFIR), which came into effect on April 13, 2024. AFIR is a key component of the EU's broader strategy to achieve a 55% reduction in net greenhouse gas emissions by 2030, as part of the European Green Deal. AFIR establishes mandatory deployment targets and technical standards for public charging and refueling infrastructure across all EU Member States. It aims to eliminate range anxiety, ensure interoperability, and provide a seamless user experience across borders.

Under the AFIR, the EU has established binding deployment targets to ensure that EV infrastructure keeps pace with the growing number of zero-emission vehicles. For passenger EVs, each Member State must provide publicly accessible charging infrastructure capable of delivering at least 1.3 kW of power per registered battery-EV. This ensures that infrastructure expansion is directly tied to vehicle uptake. To support long-distance travel, fast charging stations with a minimum output of 150 kW must be installed every 60 kilometers along the Trans-European Transport Network (TEN-T) starting in 2025. For heavy-duty vehicles, the regulation mandates the deployment of charging stations with at least 350 kW output every 60 kilometers on the TEN-T core network and every 100 kilometers on the comprehensive network, with full coverage required by 2030.

AFIR places strong emphasis on creating a seamless and user-friendly experience for EV drivers across the EU. One of the core requirements is price transparency, ensuring that users can view real-time pricing information clearly and consistently. To simplify access, all charging stations must support ad hoc payments using credit or debit cards, eliminating the need for subscriptions or proprietary apps. The regulation also mandates interoperability, requiring infrastructure to support standardized communication protocols and enable cross-network roaming. Additionally, operators are required to share real-time data on station availability, location, and pricing through electronic means, ensuring that users are fully informed and can plan their journeys with confidence.

United Kingdom

The UK has taken significant steps to standardize and enhance the public EV charging experience through the Public Charge Point Regulations 2023 (PCPR), which came into force on 24 November 2023. These regulations are designed to ensure that public charging infrastructure is reliable, accessible, and user-friendly, supporting the UK's broader transition to zero-emission transport. The PCPR introduces several mandatory requirements for operators of publicly accessible charge points:

- Reliability: All rapid charge points must achieve a 99% reliability rate, ensuring that high-speed charging infrastructure is consistently operational.
- Contactless Payment: All new public charge points with a power rating of 8 kW or above must support contactless payment via debit or credit card, eliminating the need for proprietary apps or memberships.
- Roaming: Operators must enable payment through at least one third-party roaming provider, allowing users to access multiple networks with a single account.
- 24/7 Helpline: A free, staffed telephone helpline must be available 24/7 to assist users with any issues at public charge points.
- Open Data Sharing: Operators are required to share real-time data using the OCPI protocol, including information on charger availability, location, and pricing.
- Transparent Pricing: All pricing must be displayed clearly in pence per kWh, allowing users to compare costs across networks.

These measures aim to build consumer confidence in the public charging network, particularly for those without access to home charging or traveling long distances.

In parallel with regulatory measures, the UK government – through the Office for Zero Emission Vehicles (OZEV) – offers a range of incentive schemes to accelerate the deployment of EV charging infrastructure. Programs such as the EV Chargepoint Grant, and the Workplace Charging Scheme provide financial support for the installation of charge points in residential and commercial settings. These initiatives are designed to complement public infrastructure by encouraging private investment and expanding access to charging across different environments. Together, the PCPR and OZEV's incentive programs form a comprehensive framework that not only mandates high standards for public infrastructure but also supports the broader adoption of EVs across the UK.

China

China is rapidly advancing its EV ecosystem, not only through widespread deployment of charging infrastructure but also by integrating EVs into the broader energy system. The country's regulatory framework, led by the National Development and Reform Commission and other key agencies, reflects a strategic vision to position EVs as both transportation assets and flexible energy resources.

China's regulatory approach is rooted in a high-level policy framework that emphasizes systematic planning, innovation leadership, and coordinated development. Guided by national development goals and the principles of government guidance, market participation, and multi-party collaboration, the country aims to build a robust, intelligent, and safe vehicle-grid interaction ecosystem. Innovation is central to this strategy, with a strong emphasis on standardization, safety, and international cooperation.

China's regulatory framework for EV charging and V2G integration is underpinned by a series of strategic activities aimed at building a robust, intelligent, and flexible energy ecosystem. A major focus is on technology development, with significant investment in research and innovation. This includes advancing high-cycle-life batteries capable of over 3K charge cycles, developing bidirectional charging equipment, and creating grid-friendly stations that integrate solar energy generation, storage, and charging capabilities.

Additionally, China is prioritizing the development of intelligent control systems and cyber security measures to ensure safe and efficient vehicle-grid interaction. To support this technological evolution, China is accelerating standardization efforts. By the end of 2025, the government aims to finalize key standards for communication protocols, power regulation, and safety, while establishing a comprehensive testing and certification system for V2G equipment.

These efforts are complemented by initiatives to align Chinese standards with international benchmarks, enhancing global competitiveness. On the economic front, the government is implementing TOU electricity pricing for residential charging and exploring mechanisms for compensating EVs that discharge power back to the grid. Market participation is being encouraged through aggregator involvement in demand response programs, spot markets, and carbon trading.

China is also rolling out demonstration projects to validate and refine its V2G strategies. These pilots focus on public fleets and residential communities, aiming to develop scalable business models and robust battery assurance systems. Grid companies are being encouraged to build integrated solar-storage-charging hubs and enhance distribution network access. Finally, grid integration is a key priority, with power grid companies tasked with incorporating V2G into demand-side management, improving metering and settlement systems, and enabling direct market participation through aggregator platforms.

3.2 Canada's Regulatory Landscape

Canada's approach to EV infrastructure is shaped by its national climate commitments and the need to decarbonize the transportation sector, which accounts for over 20% of the country's greenhouse gas emissions. The federal government has committed to achieving 100% zero-emission vehicle (ZEV) sales for new light-duty vehicles by 2035, and for medium- and heavy-duty vehicles by 2040 where feasible. To support this transition, Canada is implementing a multi-faceted regulatory and funding framework focused on expanding EV charging infrastructure, managing grid impacts, and ensuring equitable access across regions. This infrastructure expansion is reinforced by the Canadian Net-Zero Emissions Accountability Act, passed in 2021, which legally commits Canada to achieving net-zero greenhouse gas emissions by 2050. The Act mandates legally binding emissions reduction targets every five years, annual progress assessments, and full transparency through public reporting. Transportation is a central focus of this legislation. The Act also established the Net-Zero Advisory Body, which provides independent guidance on achieving climate goals.

To ensure that the electricity powering EVs is clean and sustainable, the federal government finalized the Clean Electricity Regulations (CER) in December 2024 under the Canadian Environmental Protection Act, 1999. These regulations set strict carbon dioxide emissions limits for fossil fuel-fired electricity generation units with a capacity of 25 megawatts or more, beginning in 2035. The CER supports the transition to a net-zero electricity grid by 2050, encouraging utilities to invest in renewable energy, battery storage, and smart grid technologies. Canada's regulatory and policy framework for EV infrastructure reflects a coordinated national effort to decarbonize transportation and modernize the electricity grid. Together, these initiatives lay the foundation for a resilient, equitable, and future-ready transportation ecosystem.

3.3 Existing Initiatives in Canada

Canada's commitment to expanding EV infrastructure is supported by a range of strategic initiatives and demonstration programs that aim to accelerate innovation, improve grid integration, and ensure equitable access to charging across the country.

Canada–United States Binational EV Charging Corridor: In May 2023, the Government of Canada announced a landmark partnership with the United States to establish a binational EV charging corridor. This corridor will stretch from Kalamazoo, Michigan to Quebec City, Quebec, with Level 3 fast chargers planned approximately every 80 kilometres. The initiative is designed to support cross-border EV travel, enhance regional connectivity, and promote North American cooperation on clean transportation infrastructure.

Electric Vehicle Infrastructure Demonstration (EVID) Program: The EVID Program, administered by NRCan, was allocated $76M under Budgets 2016 and 2017 to support the demonstration of next-generation EV charging and hydrogen refuelling technologies. The program aims to accelerate the market entry of innovative clean energy infrastructure by funding projects that address both technical and non-technical barriers to deployment. To date, over 20 demonstration projects have been launched across six provinces and one territory, in both urban and remote settings.

The Program has successfully met its core objectives by delivering demonstration projects across all priority areas. It has remained responsive to the evolving needs of the electric mobility sector, ensuring that selected projects effectively address key barriers and gaps.

Energy Innovation Program – Smart Grids: The Energy Innovation Program – Smart Grids is a federal initiative led by NRCan that supports the development and scaling of smart grid technologies. The program, which closed for new proposals in May 2025, provides funding for projects that address technological, market, and regulatory barriers to the widespread deployment of smart grid solutions, including those that enable smart EV charging, load balancing, and real-time energy management.

Clean Energy for Rural and Remote Communities Program: The Clean Energy for Rural and Remote Communities Program, launched in 2018, supports the deployment of renewable energy systems, microgrids, and EV charging infrastructure in off-grid Indigenous and remote communities. The program aims to reduce reliance on diesel fuel, improve energy security, and support local economic development. Key objectives include:

- Supporting clean energy transitions in remote areas
- Enhancing community resilience and energy independence
- Building local capacity through training and community-led energy planning
- Promoting Indigenous leadership in clean energy development

Projects funded under this program often include solar, battery storage, and EV charging stations integrated into community microgrids, helping to reduce emissions and improve quality of life in underserved regions. To date, over 190 projects have been supported nationally, with a total of $453M allocated to the program since its inception.

ZEVIP: ZEVIP, administered by Natural Resources Canada (NRCan) – the federal agency responsible for overseeing national energy policy and infrastructure – is a key federal initiative that provides funding for the deployment of EV chargers and hydrogen refuelling stations across the country. ZEVIP targets installations in public places, workplaces, MURBs, and on-road vehicle fleets, with dedicated funding streams for Indigenous communities and delivery organizations. The program covers up to 50% of total project costs (or 75% for Indigenous-led projects) and is available until 2027. It directly addresses one of the most significant barriers to EV adoption – limited access to charging infrastructure – by supporting the development of a coast-to-coast network.

4. Ontario's EV Charging Landscape

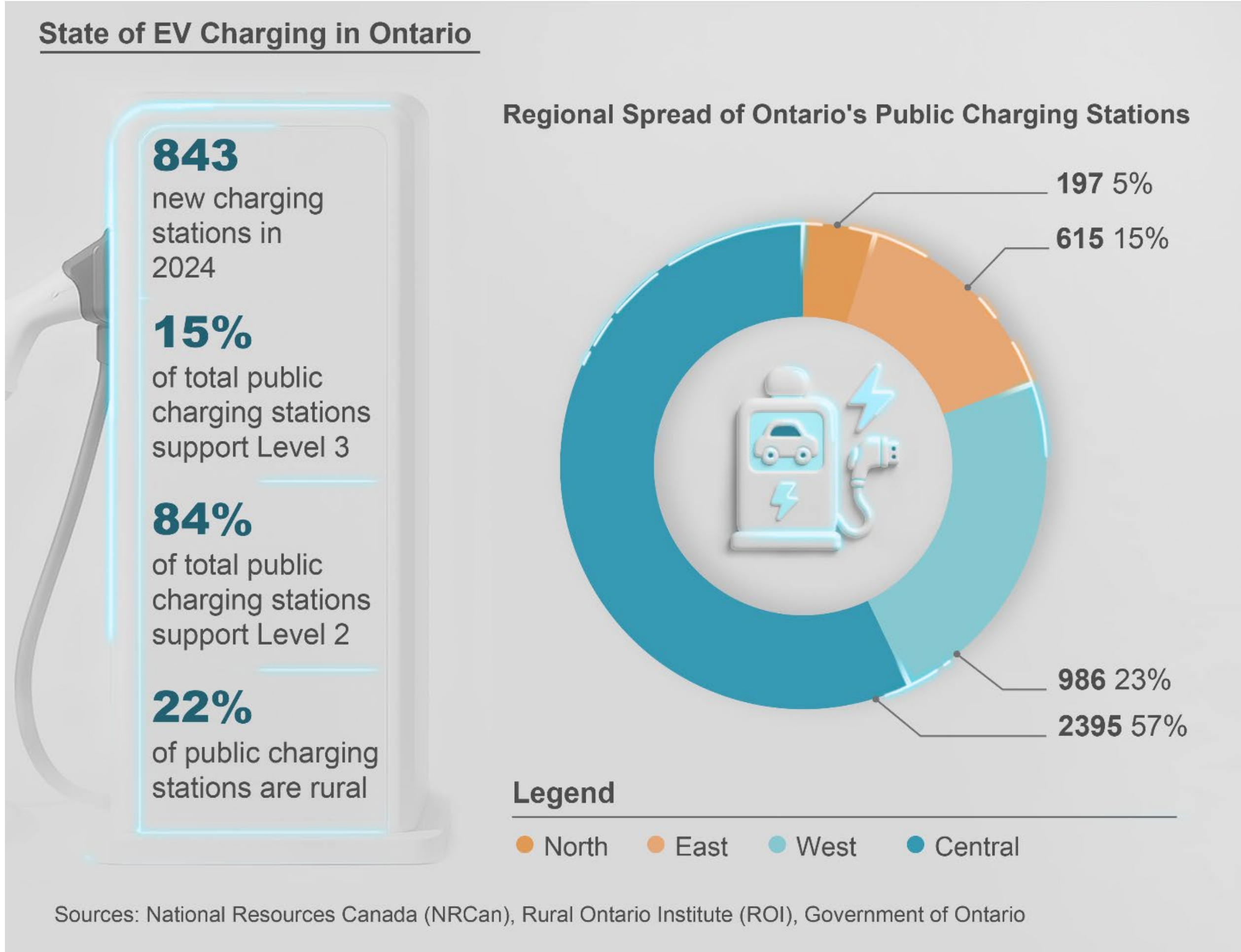
The expansion of EV charging infrastructure in Ontario requires coordinated efforts across government, industry, and utility providers. Strategic planning is underway to ensure that the province's electricity grid can support the growing demand for EVs. This includes assessing grid capacity, forecasting future electricity needs, and exploring solutions to integrate charging infrastructure efficiently and equitably. As EV adoption rises, so too does the importance of balancing energy supply with demand, maintaining grid reliability, and optimizing charging patterns. The landscape is shaped by a diverse set of stakeholders, including public agencies, energy providers, and technology firms. Their collaboration is essential to building a robust and accessible charging network that meets the needs of urban centers, rural communities, and long-distance travelers alike.

4.1 Ontario's Electricity Grid

Distribution of Charging Infrastructure

The vast majority of Ontario's public EV charging stations are concentrated in the densely populated south, particularly in major urban centres such as Toronto, Ottawa, Mississauga, London, and along the 400-series highways, reflecting where EV adoption is highest. By contrast, rural areas and the far north have significantly fewer charging stations, leading to the creation of "charging deserts" on remote corridors.

As of the most recent data, there are approximately 4.2K EV charging stations across the province, housing a total of about 11.9K chargers. The majority of charging stations, around 78%, are in urban areas, while 22% are in rural communities. This distribution follows similar trends in EV adoption with urban residents possessing a much greater share of EV ownership. Ontario's charging network is primarily composed of Level 2 chargers, which make up 84% of all chargers. These are commonly used for public and residential charging. Level 3 chargers, which allow for quicker charging, account for 16% of the total



and are more evenly distributed, with 42% located in rural areas. As of July 2025, close to 10% of all public EV charging stations in Ontario have at least one connector available that could enable bidirectional or V2X flow of power provided other conditions are met.

When it comes to regional distribution, the Central region, which includes municipalities such as Toronto, York, Peel, and others, leads in infrastructure, hosting 57% of all charging stations. This is followed by the West (24%) which includes municipalities such as Waterloo, Windsor, and Niagara. Next comes the East (15%), which comprises Ottawa, Peterborough, Kingston, and other upper tier municipalities, and finally the North (5%), comprised of municipalities such as Nipissing, Algoma, and Thunder Bay. The concentration in central Ontario reflects higher population density and vehicle usage but also points to opportunities for expanding access in northern and eastern regions.

The rollout of EV charging stations has accelerated rapidly. From just a handful of installations in the early 2010s, the number of new stations surged to 940 in 2023. The province is seeing continued growth, with 853 new stations being opened in 2024 and 330 more in 2025 (as of July 2025). This upward trend underscores Ontario's proactive approach to building a robust EV ecosystem.

Until 2019, an average of five EV charging stations were opened in Northern Ontario every year. The number has since increased to average of 26 new EV charging stations being opened every year in the last four years in part due to initiatives by local utilities and the Ivy Charging Network, deploying dozens of fast chargers along highway corridors with support from Hydro One. Through other initiatives like ChargeON, which is highlighted in an upcoming section, the Ontario government's strategy explicitly targets these gaps, aiming for a more even geographic distribution of charging so that EV drivers across all regions of the province benefit from reliable and seamless connectivity.

Forecasted Electricity Demand

The growth of EVs will have a transformative impact on Ontario's electricity demand over the next 10-25 years. The Independent Electricity System Operator's (IESO) latest planning forecasts show transportation electrification as one of the largest new sources of load on the grid. In the 2025 Annual Planning Outlook, for instance, the IESO projects that EV charging and rail electrification will cause Ontario's transportation sector electricity use to skyrocket from only about 3 TWh in 2026 to roughly 44 TWh by 2050. This is an increase of over 40 TWh, representing a 1,382% growth, or an average growth of 11.9% per year.

The table on the next page tracks the projected growth of EV electricity demand in Ontario alongside the province's total system-level net annual energy demand from 2026 to 2050 as forecasted by IESO in its 2025 Annual Planning Outlook. The data shows a clear upward trend in both EV electricity consumption and overall energy demand. In 2026, EVs are expected to consume 2.33 TWh, representing just 1.5% of Ontario's total demand of 156.67 terawatt hours (TWh). By 2030, EV demand more than triples to 8.11 TWh, accounting for 4.3% of the total. This growth accelerates significantly by 2035, with EVs consuming 21.63 TWh, or 10.1% of the province's 214.78 TWh demand.

The trend continues through 2040 and 2045, with EV demand reaching 32.86 TWh and 38.93 TWh, respectively, making up 13.8% and 15.6% of total demand. By 2050, EVs are projected to require 41.75 TWh, which is 15.9% of Ontario's total projected demand of 262.48 TWh. This trajectory of rising electricity demand from EV charging aligns with Ontario's EV adoption targets and policies.

The federal mandate for 100% of new light-duty vehicle sales to be zero-emission by 2035 (with an interim target of 60% by 2030) is baked into IESO's models. As a result, the light-duty EV fleet in Ontario is forecasted to grow from around 400K EVs in 2025 to 11.5M in 2050. The growth represents a nearly 18-fold increase in electricity demand from EVs over 25 years, with EVs accounting for just 1.5% of total demand in 2026, but rising to nearly 16% by 2050.

Such a shift is not just a matter of increased consumption; it fundamentally changes the load profile of the grid. It is clear from the IESO forecast that grid readiness will form a major, if not the most, important component of ensuring that EVs are safely and efficiently integrated into Ontario's wider electricity system.

Ontario is taking a comprehensive approach to address growing energy and electrification demands. This includes expanding generation capacity, particularly from clean and flexible sources, to meet rising consumption. The province is also upgrading its distribution systems to support increased residential and commercial EV charging, with tailored strategies for both rural and urban areas. Smart charging infrastructure, such as TOU pricing and V2G integration, is being implemented to manage peak demand and enhance grid efficiency. Additionally, Ontario is investing in battery storage and demand response programs to balance the variability of renewable energy and EV charging patterns. To support these efforts, the province is also working to strengthen supply chain resilience for critical components.

EV Charging Infrastructure Workforce

Transitioning to electrified mobility also means new jobs and skills are generated through EV charging infrastructure, not just the vehicles themselves. Representing a wide ecosystem with roles spanning from operators, electricians, technicians, engineers, surveyors, estimators, construction managers, and site acquisition agents, EV charging infrastructure offers unique opportunities for current and future professionals.

As both new workers and skills are required, educational institutions and other organizations are pivoting to address this need. George Brown

Ontario EV Energy Demand as a Share of Total Demand (2025–2050)

	EV Demand (TWh)	Total Energy Demand (TWh)	EV Share of Total Demand (%)
2050	41.75	262.48	15.9%
2045	38.93	248.78	15.6%
2040	32.86	238.09	13.8%
2035	21.63	214.78	10.1%
2030	8.11	188.91	4.3%
2026	2.33	156.67	1.5%

Source: IESO Annual Planning Outlook (2024)

College offers EV Technician training, which is tailored to automotive service technicians looking for skills to work on EVs and electricians installing, services, and maintaining EV charging stations. Other examples include the International Brotherhood of Electrical Workers, where Local 353 offers a specific EV infrastructure training program. Seneca Polytechnic notes that graduates of their three-year advanced diploma program in Electronics Engineering Technology opens careers opportunities for becoming an EV charging electrical design technologist. Experts have noted the importance of expanding educational opportunities in Ontario to meet the knowledge requirements of a growing EV industry.

OVIN published a Spotlight on Skills, Talent & Workforce Development focused on EV automotive repair, aftermarket, and infrastructure for electrification. The report finds that reskilling may help workers adapt to the increased digitization of electrifying the province's mobility. These insights demonstrate the variety of current and future opportunities and industry needs that are shaping Ontario's workforce and influencing educational initiatives offered across the province.

Local Distribution System Readiness

The readiness of the electric grid to accommodate EV charging varies widely by region. In dense urban centers like Toronto and Ottawa, the distribution networks are extensive but aging as many transformers and feeders are already heavily loaded. Toronto Hydro reports that parts of the city's grid are under "increasing strain" from growth and electrification, and it has embarked on a $5.1B grid modernization plan (2025-2029) to boost capacity and reliability. Smaller city and suburban utilities (e.g., Alectra Utilities, serving Mississauga, Vaughan, Markham and other Greater Toronto Area suburbs) are also seeing increasing residential EV uptake that can strain neighborhood infrastructure.

By contrast, in many rural areas served by Hydro One, the issue is long feeder lines and small communities where a new fast-charging site, or a few dozen EVs in one village, can suddenly become a large fraction of the local load. Accommodating large EV charging stations, such as for electrified truck fleets or highway rest stops, would require significant feeder and transformer upgrades on rural distribution systems. In Northern Ontario, a majority of First Nations communities and towns are on radial or diesel-supplied grids with very limited spare capacity. Integrating EV charging there may entail broader energy system upgrades such as adding renewables, storage, or new lines beyond just the charger hardware.

Grid Bottlenecks and Utility Mitigation

As EV charger installations increase, LDCs are encountering bottlenecks in their electricity networks.

Overloaded transformers: Small transformers on residential streets, especially older 10-25 kilovolt-ampere (kVA) units, have not been designed for the high, simultaneous demand of multiple EVs charging. To address this, utilities like Niagara-on-the-Lake Hydro are considering replacing smaller transformers with larger ones in areas with growing EV adoption as week as updating design standards to use higher-capacity transformers in new subdivisions. Experts also note the critical role of transformers in enabling the full potential of smart grids and EV charging. Coupled with other technology solutions like AI and machine learning, transformers and other grid infrastructure requires attention to enable a fully smart ecosystem.

Constrained distribution feeders: The main power lines (feeders) that run through neighborhoods can also become overloaded. When originally built, these were sized based on typical household use and not the added load of EVs. As more homes charge EVs, some feeder segments may hit their capacity limits, especially older or lower-voltage ones. Voltage drop is another concern, especially in rural areas where long lines can lead to low voltage at the end of the circuit. Upgrading feeders is more complex than replacing transformers, particularly for underground lines. To address this, it is likely that utilities may look to solutions such as prioritizing upgrades to the most at-risk feeders, using energy storage or scheduled charging to reduce peak loads, and encouraging smaller, spread-out charging sites instead of large, centralized hubs.

Substation transformer limits: At a higher level, substations that step down power from the transmission grid to local networks are also under pressure. These large transformers (10-50 mega volt-ampere (MVA)) serve entire towns or districts. In Ontario, many are nearing their capacity limits due to urban growth and rising electricity use, including EV charging. Adding or upgrading a substation transformer is expensive and time-consuming. Some areas, like downtown Toronto or fast-growing suburbs, may need new substations by the early 2030s.

Interactive Capacity Maps

In 2022, the OEB directed all electricity distributors to provide public information on their system's spare capacity, to assist customers planning EV chargers and other new loads. In response, at least 15 LDCs, out of Ontario's 59 LDCs, have launched online capacity maps as of 2025. Toronto Hydro was the first major utility to do so and rolled out its interactive Load Capacity Map in early 2025. The map offers a high-level visualization of how much additional load each 27.6/13.8 kilovolt (kV) substation in the city can accommodate without upgrades. This allows EV charging companies and site hosts to select suitable locations in the early planning stage, potentially avoiding lengthy upgrade costs.

Other utilities have also followed suit. Alectra Utilities launched its map in March 2025. Further, throughout Ontario, Hydro One, Enwin, Milton Hydro, Oakville Power, Entegrus Powerlines, and Halton Hills Hydro Inc. have provided interactive distribution load capacity maps for their service areas. Meanwhile, smaller utilities like London Hydro, Lakeland Power Distribution Limited, Canadian Niagara Power, Niagara Peninsula Energy, Niagara-on-the-Lake Hydro, Oshawa Power, NT Power, and Eastern Ontario Power provide PDF versions of estimated load capacity within the areas they service.

Going forward, the OEB's Phase 2 of this initiative will push for consistent, advanced maps that will be made available at a centralized provincial platform by December 2025 to ensure all stakeholders have easy access to up-to-date distribution capacity information. Capacity maps are emerging as a key planning aid to pinpoint grid bottlenecks and available pockets of capacity in Ontario's EV charging rollout.

4.2 Ontario's Strategic EV Charging Initiatives

Ontario is home to a diverse range of pilot projects and technology demonstrations that are advancing EV charging infrastructure, grid integration, and smart energy management. These initiatives are led by utilities, private companies, and public agencies, often in collaboration with federal programs and local institutions.

Provincial Programs and Strategies

Ontario's government is advancing strategic initiatives to expand EV charging infrastructure with an emphasis on affordability, reliability, safety, and accessibility. Central to Ontario's EV programming is ChargeON, which provides funding to municipalities, Indigenous communities, non-profits, and private sector partners to install public EV chargers. It is highlighted in the next page.

OVIN R&D Partnership Fund – Advanced Charging and V2G Stream: A cornerstone initiative supporting Ontario-based SMEs in developing, testing, and validating innovative EV charging and grid integration technologies. With co-investments of up to $1M, it targets key challenges such as wireless, high-speed, and bidirectional charging; smart and dynamic charging systems; V2G; renewable energy integration; grid and energy demand management; and advanced energy storage and transmission solutions. By fostering collaboration between SMEs, industry, and research partners, the program accelerates the commercialization of technologies that strengthen Ontario's leadership in sustainable mobility.

Electric Vehicle Charger Discount Electricity Rate: To further reduce costs and encourage investment in emerging markets, Ontario is developing a new rate to lower electricity costs for public EV chargers in areas where demand is still developing, helping to make infrastructure more economical and giving drivers greater confidence to switch to EVs. The new rate is expected to come into effect on January 1, 2026.

Electric Vehicle Charging Connection Procedure: Ontario is also enhancing reliability and safety through the Electric Vehicle Charging Connection Procedure (EVCCP), introduced in May 2024. This regulation mandates that all local electric utilities follow a standardized process for installing and connecting new EV chargers. The EVCCP streamlines coordination between developers and utilities, reduces administrative delays, and ensures consistent technical standards across Ontario's charging network.

ULO Electricity Price Plan: Introduced in 2023 to support energy affordability and grid efficiency, the plan offers significantly reduced electricity rates between 11 p.m. and 7 a.m., encouraging EV owners to charge their vehicles during off-peak hours.

Ivy Charging Network Expansion: Supported by Hydro One, the Ivy Charging Network now includes 150 fast chargers across more than 60 locations. In partnership with the Ontario government, Level 3 chargers were installed at all 20 ONroute highway service centres along Highways 400 and 401 to improve long-distance EV travel.

Affordable Energy Act: Receiving royal ascent in December 2024, part of the Affordable Energy Act confirms that EV charging station owners and operators are not subject to regulation by the Ontario Energy Board, providing clarity needed for the private sector to invest in charging infrastructure.

Ontario Spotlight: ChargeON

Launched by the government of Ontario, the EV ChargeON program provides funding for public EV charger installation across the province with the aim of building a more connected network, improving charger accessibility and affordability, and encouraging EV adoption. In 2023, the program initially began the process of committing $91M to install over 1.3K new EV charging ports in communities all over Ontario. Currently administered by the Ministry of Transportation (MTO), the program consists of two streams: the Community Sites Stream and the Government Sites Stream.

The Community Sites stream offers application-based grants for eligible private, public, and non-profit sector entities and Indigenous communities to support installation in unserved areas. To date, over 270 projects have been approved for funding across sites like arenas, hospitals, and parks. With this, the program is supporting 190 new charging ports in Northern Ontario. The Government Sites Stream is focusing on government-owned property in underserved and remote areas across Ontario. Sites include highway rest areas, carpool parking lots, and tourist destinations.

ChargeON's mandate is particularly valuable in areas where government support is needed to incentivize EV charging infrastructure investment, such as seasonal locations that see greater activity during specific months of the year and remote areas that experience lower utilization due to fewer users but remain important to enabling local EV adoption and long-distance travel. By covering up to 75% of project costs for eligible applicants, the program makes it easier for communities across the province to participate in the EV transition. ChargeON is also supporting potential EV owners by increasing opportunities for reliable public charging, which is a known challenge for increasing EV adoption.

Additional support for the program was announced in Budget 2025, with the government committing an additional $92M for a total of over $180M to expand the program. As ChargeON evolves and expands, the MTO is currently reviewing findings and feedback to ensure the program continues to meet the specific needs of Ontarians across the province. MTO is also exploring how the program can also consider supporting technologies to future-proof the province's charging infrastructure and support Ontario's grid readiness.

V2G Demonstrations

Blackstone Energy Services V2G Pilot: This project tested bi-directional charging technology at Ontario colleges, allowing EVs to discharge electricity back to the grid or facility during peak demand. It explored how EVs can serve as DERs and support grid stability.

Peak Power – Peak Drive V2G Pilot: One of the largest V2G demonstrations globally, this pilot used Nissan Leaf vehicles and bi-directional chargers across three commercial buildings in downtown Toronto. It showcased the potential of EVs to provide grid services and reduce peak electricity demand.

Smart Charging and AI Integration

BluWave-ai & Hydro Ottawa EV Everywhere Pilot: This project used AI to manage EV charging during peak demand periods. Supported by the IESO and OEB, it demonstrated how AI can optimize charging schedules to reduce grid stress and energy costs.

Toronto Hydro Smart Charging Pilot Program: In partnership with Plug'n Drive and Elocity Technologies, this pilot provided residents with smart charging devices to monitor and control their EV charging. The program collected data on charging patterns to inform future infrastructure planning and demand management.

SWTCH: Smart EV Charging for Multi-Unit Residential Buildings: Supported by OVIN's Research and Development Fund, Talent Development (Talent Internship Project) and Regional Technology Development Site (RTDS), SWTCH has developed an intelligent EV charging platform, Cortex, that manages load balancing in multi-unit buildings to improve grid efficiency.

SWTCH & Kite Mobility: High-Density Community Charging Optimization: In July 2025, SWTCH completed a multi-tenant EV charging project in partnership with Friday Harbour Resort, Kite Mobility, and OVIN. The project installed 15 smart load-managed Level 2 chargers at a luxury resort community, using SWTCH Control™ to dynamically adjust charging based on real-time energy consumption, reducing strain on the local grid and enabling broader EV adoption. The project also integrated Kite's shared mobility platform, allowing residents to reserve and use shared EVs and micromobility vehicles, promoting sustainable transportation in high-density settings.

Clockwork's Smart Charging Operations Platform: An innovative project that leverages AI to enhance the reliability and efficiency of EV infrastructure. Clockwork has developed an AI-powered operations platform that monitors the health of EV chargers, detects anomalies, and automates maintenance tasks. Supported by OVIN and partnered with BGIS, the project aims to scale smart charging networks while minimizing operational costs and grid impact.

Elocity HIEV-Nano Platform: A smart EV charging project showcasing cutting-edge integration of AI and bi-directional energy technologies. Elocity's HIEV-Nano platform, supported by OVIN, enables dynamic energy management by allowing EVs to not only charge but also discharge energy back to homes, buildings, or the grid.

Public Transit Electrification

TTC & PowerON Energy Solutions eBus Charging Pilot: The Toronto Transit Commission (TTC) installed 10 overhead pantograph chargers at its Birchmount Garage in Scarborough. Delivered in partnership with

PowerON Energy Solutions, this pilot supported the electrification of TTC's bus fleet and tested high-capacity depot charging solutions.

Blockchain and Energy Innovation

SWTCH & Opus One Blockchain-Based Charging Pilot: This demonstration tested the use of blockchain technology to track energy usage and billing for EV charging in office buildings in Toronto. It also explored the concept of EVs as power sources for building residents, advancing the idea of decentralized energy systems.

Heavy-Duty and Industrial EV Charging

HydroOne Heavy-Duty Truck Charging Pilot: Funded by NRCan, this pilot aims to develop a scalable model for heavy-duty electric truck charging. It addresses the unique infrastructure and grid requirements of commercial freight electrification.

Stromcore e-Forklift Charging Investment: With support from the federal government, Stromcore launched two new products: Turbo Bank, an AI-powered fast charger, and Electric Cart, a cold-weather-capable e-forklift. These innovations support industrial electrification and fast-charging in challenging environments.

Autonomous and Wireless Charging Innovation

Jule Fast Charging System for Autonomous Vehicles: With support from OVIN's Talent Development Program, Jule expanded its engineering team to develop and deploy fast-charging stations tailored for autonomous vehicles (AVs).

eLeapPower Wireless AV/EV Charging Project: Supported by OVIN's R&D and Talent Development programs, this project explored wireless and autonomous charging solutions for connected and electric commercial vehicles, addressing last-mile infrastructure challenges.

TROES & Day & Night Solar Transportable EV Charging Station: Funded through OVIN's R&D EV Stream, this project is developing a solar-powered, portable Level 3 charging station with a collapsible BESS. The system is designed for rapid deployment and grid support, offering flexible charging in remote or temporary locations.

> "Our government is paving the way to an electric future by building the EV charging infrastructure drivers need, where they need it. By increasing the accessibility of public EV charging stations across the province, including for rural and northern communities, we are providing more sustainable and convenient travel options for drivers."

– The Honourable Prabmeet Sarkaria, Minister of Transportation

4.3 Ontario's Smart Grid and Digital Infrastructure Initiatives

Smart Grid and Advanced Metering

Ontario is emerging as a global leader in EV grid integration. Through a decade-long commitment to smart grid innovation, the province has laid a digital foundation that enables real-time energy management, supports clean transportation.

At the heart of Ontario's endeavour is its advanced metering infrastructure (AMI), which includes nearly universal deployment of smart meters across homes and businesses. These meters enable TOU billing and provide granular, near real-time data on electricity consumption. This data is essential for managing EV charging, as it allows utilities to monitor demand patterns and helps consumers shift charging to off-peak hours, reducing strain on the grid and lowering costs.

To foster innovation and empower consumers, Ontario has mandated the Green Button data standard. This initiative allows consumers to securely share their energy usage data with third-party applications, enabling the development of smart charging solutions and energy management tools. By opening up access to energy data, Ontario is encouraging a new wave of digital services that can optimize EV charging schedules, reduce costs, and enhance grid reliability.

Ontario's smart grid is underpinned by a vast data infrastructure. The province's Meter Data Management/Repository (MDM/R) stores billions of data points from smart meters, which utilities use to analyze EV charging patterns. Early pilot projects have equipped EVs with data loggers to track when and where charging occurs, feeding into AI-enhanced models that forecast localized impacts on the grid. These insights enable utilities to create "heat maps" of EV adoption, identify transformers at risk of overloading, and develop customer-specific programs such as alerts for high-demand charging behavior.

Digital and Software Solutions and Services

Ontario is also home to a growing ecosystem of software platforms designed to manage EV charging at scale. In one example, BluWave-ai, based in Ottawa, has developed the "EV Fleet Orchestrator," a cloud-based platform that optimizes the charging of electric fleets using real-time data from weather forecasts, electricity prices, charger status, and vehicle telematics. This tool enables vehicle fleet operators, including municipal mass transit, last-mile delivery, airport ground support and others to stagger charging, reduce peak loads, and even use EVs as backup power sources, delivering both operational savings and grid benefits.

Utilities are also investing in innovation. The IESO supports projects covering smart charging and battery storage through its Grid Innovation Fund (GIF). Since 2005, the GIF has supported innovative energy projects across Ontario to achieve electricity bill savings for ratepayers. Since its establishment, the GIF has funded over 260 projects, including those supporting EV charging infrastructure. Since 2019, the total project value is over $110M, with $9.26M invested in 2024.

Another initiative is the Ontario Energy Board's Innovation Sandbox which provides regulatory flexibility for vehicle-grid integration pilots. These initiatives are helping Ontario transition from static infrastructure to intelligent, software-defined energy systems, while acting as an example for other jurisdictions that seek to enable effective EV-to-grid integration.

Ontario is also exploring new models such as SaaS to manage charging demand. SaaS for EVs provides on-demand access to battery storage, helping balance the grid, manage energy costs, and support renewable integration. For example, in the EV Everywhere pilot, Moment Energy, a company that repurposes retired EV batteries, will be deploying second-life EV batteries to provide extra capacity during peak periods. This model allows utilities to defer costly infrastructure upgrades by contracting third parties to supply stored energy when needed. Similarly, Toronto-based cleantech company Peak Power's decarbonization platform aggregates EVs and batteries into a "virtual power plant" that can participate in peak reduction programs. These SaaS models offer both operational and economic benefits, turning EVs into assets that support grid stability and resilience.

DERs, BESS, and Microgrid Initiatives

Ontario has encouraging DER installation, such as rooftop solar, that help offset the electricity used by EVs. Two key programs have supported DERs in Ontario: microFIT (Feed-in-Tariff) and Net Metering. The microFIT program ran from 2009 to 2017 and provided homeowners and other suppliers with a guaranteed price for the electricity they produced from a 10 kW or less renewable electricity generation project on their property over a 20-year term. Net Metering, an ongoing program, allows consumers to use the electricity they generate for their own needs and send any extra power back to the grid in return for credits on electricity bills which helps lower future energy costs. The credits also work by offsetting the energy an EV consumes at night from the grid. An example of a community utilizing DERs for EV charging is North Bay's Community Energy Park, where a 10 kW tracking "solar flower" charges a 250 kW battery that in turn powers public chargers, ensuring vehicles can refuel even if the larger grid is offline.

As discussed earlier, the global BESS market is seeing a boom in tandem with EV adoption. Ontario boasts some examples of this technology. Transit agencies such as the TTC, working with Ontario Power Generation (OPG) subsidiary PowerON, are designing bus garages with utility-owned BESS that charge slowly off-peak and then fast-fill e-buses at shift change, flattening the depot's load profile and lowering lifetime fleet costs. Also in Toronto, Peak Power coordinated an EV and an energy storage system to act as a VPP, helping reduce the building's demand form the grid during peak periods.

Ontario has also explored the role that microgrids can play in supporting and optimizing EV charging. An example of a microgrid pilot is the Opus One Smart Grid Energy Community Microgrid Project in Pickering, Ontario. The initiative involves 27 townhomes equipped with rooftop solar panels, a battery energy storage system, and an EV charger. The project integrates these components through a smart energy platform, allowing coordinated use of solar, storage, and EV charging.

4.4 Ontario's Demand-Response and Load Optimization Initiatives

In terms of demand-side load management and optimization in Ontario, a layered approach is being explored, incorporating economic signals such as TOU rates, managed EV charging systems that coordinate demand, and bidirectional energy flows where EVs supply power back to buildings, homes, and even the grid.

Pricing Strategies

Ontario anticipates a 75% increase in electricity demand by 2050, making efficient grid use essential. The province has introduced measures like the ULO price plan to encourage off-peak EV charging, offering a discounted price from 11 p.m. to 7 a.m. This helps flatten the load and use surplus nighttime generation. Further, the Ontario Energy Board (OEB) is developing discounted delivery rates for public EV charging stations that have a low load factor (i.e., high capacity but infrequent use). It is estimated that $5.7M may be saved per year in capacity costs with enough customers shifting to the ultra-low-rate plan. The tariff structure, in effect, acts as a "virtual managed charging" mechanism, shifting load to times when the system is most flexible.

Additionally, Ontario was among the first jurisdictions in North America to roll out TOU pricing for nearly all residential customers. These pricing strategies support EV adoption while mitigating stress on peak hours. Utilities and other key players are also piloting "smart charging" and V2G projects – such as Alectra's AlectraDrive @Home and Peak Power's pilot programs. These efforts aim to ensure the grid is neither overbuilt nor overwhelmed.

Managed Charging Initiatives

Managed charging lets utilities adjust EV charging in real time to avoid energy spikes, keep the grid stable, and use more renewable power – going beyond just using price signals. Ontario has been piloting managed programs to explore these solutions. In one example, BluWave-ai successfully completed Canada's first AI-driven demand response/managed charging event using a diverse pool of EVs in partnership with Hydro Ottawa. The company's EV Everywhere™ platform intelligently paused charging sessions during peak periods, helping stabilize the grid and increase renewable energy use. Another example is Alectra's AlectraDrive @Home, which studied how EV owners respond to incentives and automated controls. Experts note the importance of offering incentives when building an effective grid management system. Consumers need specific motivation to participate in programs that may require utilities to control their EV charging, like during heat waves when the grid can be severely constrained.

V2X Initiatives

V2X technologies allow EVs to communicate and send power back to the grid or other systems, offering greater flexibility, improved energy resilience, and new ways to earn revenue. Ontario is already deploying V2X charging technologies. In 2019, the Peak Drive project deployed 21 bidirectional Level 3 chargers connected to Nissan Leaf vehicles across three office towers. During high-demand hours, the cars discharged into the buildings, offsetting utility bills by as much as $8K annually per EV. Though widespread V2G is still constrained, its long-term promise is enormous. It is projected that by 2040, the collective discharge capacity of Ontario's EVs could exceed the province's summer peak demand. If used strategically, this latent resource could provide peak electricity at far below the cost of building and operating natural gas-based peaking facilities.

4.5 Key Players in Ontario's EV Charging Infrastructure Ecosystem

Ontario's EV charging infrastructure ecosystem is rapidly evolving, driven by a diverse group of stakeholders that include private companies, regulatory bodies, and utility providers. This ecosystem spans hardware manufacturing, software development, energy storage, and smart grid integration. Key players are not only enabling the expansion of EV charging networks across residential, commercial, and public sectors, but are also innovating in areas such as AI-driven energy management, wireless charging, and battery technology. Regulatory agencies and local utilities play a critical role in shaping policy, standardizing grid connections, and supporting the deployment of charging infrastructure across the province.

Regulatory Bodies

Ontario Energy Board: Serves as the primary regulator for electricity and natural gas utilities across the province. To streamline the integration of EV charging infrastructure, the OEB introduced the EVCCP.

Independent Electricity System Operator: Manages Ontario's electricity system and oversees long-term energy planning. It supports EV charging integration through programs like the GIF, which funds pilot projects that explore smart charging, V2G technologies, and grid reliability.

Major Utility Companies

Toronto Hydro: Municipally owned electricity distribution company serving the City of Toronto. In the EV charging space, Toronto Hydro supports infrastructure deployment through strategic partnerships and planning, aligning with the city's net-zero goals.

Alectra Utilities: Serves multiple municipalities including Mississauga, Vaughan, and Hamilton. It is active in smart grid and EV charging pilot programs, including V2G research, and has developed a customer-facing website dedicated to EV education.

Hydro One: Primarily serves rural and remote areas across Ontario, covering 26% of the province's total customers. It facilitates grid connections for public fast-charging stations, especially along highways and in underserved regions.

EV Charging Infrastructure Providers

United Chargers (Toronto): A leading Canadian EV charger manufacturer known for its Grizzl-E line of chargers. It focuses on durable, affordable, and scalable charging solutions for homes and businesses.

Autochargers.ca (Markham): A subsidiary of United Chargers, it specializes in selling, installing, and maintaining EV chargers for homes and businesses.

Evolute Power (Toronto): Specializes in EV charging and energy management solutions, with a strong focus on MURBs. Its flagship technologies – like the Evolute™ Smart Panel and Evolute PRO platform – enable scalable, station-agnostic charging that integrates seamlessly with building infrastructure. With support from OVIN, and in partnership with Eaton Industries Canada, Evolute Power is advancing its smart energy management system for EV infrastructure.

Kiwi Charge (Toronto): Offers Charging-as-a-Service (CaaS) through autonomous mobile units that deliver power directly to parked EVs, eliminating the need for costly infrastructure upgrades.

metroEV (Markham): Offers installation services for EV chargers across residential, commercial, and institutional sectors.

SWTCH (Toronto): Provides tailored EV charging solutions for multi-tenant buildings, supported by a robust charging management platform.

Jule (Toronto): Integrates Level 3 charging with smart energy and battery storage systems, enhancing grid responsiveness. Previously known as eCamion, the organization collaborated with Ontario Tech University's ACE via OVIN's Durham RTDS to develop end-to-end energy storage and fast charging technology.

SolarBank Corporation (Toronto): Expanding into EV infrastructure with fast-charging projects in Woodstock, Peterborough, and Milton, in collaboration with AI Renewable and First Nations communities.

Battery and Energy Storage Technology

Gbatteries (Ottawa): Innovates in intelligent battery management for electric mobility.

Peak Power (Toronto): Provides software-driven energy storage and optimization solutions for buildings, vehicles, and the electricity grid.

TROES (Markham): Offers modular battery energy storage systems with integrated microgrid controllers.

Stromcore Energy Inc. (Mississauga): Designs lithium-ion battery systems for industrial use and is advancing fast-charging technologies.

AlumaPower (Sarnia): A cleantech startup pioneering air-aluminum battery technology that transforms scrap aluminum into clean, long-duration energy. With support from OVIN, AlumaPower is working in collaboration with Festival Hydro to field trial a grid independent power generator for charging EVs.

e-Zinc Inc. (Toronto): Pioneering zinc-based long-duration energy storage solutions. e-Zinc has developed a breakthrough electrochemical technology that stores energy in zinc metal, offering a safe, affordable, and recyclable alternative to conventional batteries. With support from OVIN, and in partnership with Toyota Tsusho Canada, e-Zinc is developing its innovative storage solutions for applications like advanced EV charging.

Smart Charging and AI-Driven Solutions

BluWave-ai (Ottawa): Developed EV Everywhere, an AI-powered platform for intelligent EV charging scheduling.

Clockwork (Kitchener): Develops EV charging operations software that provides operators with a real-time, end-to-end view of charger performance and system health. With support from OVIN and in collaboration with BGIS Global Integrated Solutions, the company is building an AI-powered platform to improve the reliability and efficiency of EV charging infrastructure.

eLeapPower (Toronto): Developing efficient powertrain systems and wireless chargers that enable EVs to charge directly from renewable sources.

Elocity Technologies Inc. (Toronto): Offers bi-directional smart charging systems (HIEV-Nano) with solar and battery integration capabilities. With support from OVIN, Elocity Technologies is working in partnership with Milton Energy and Generation Solutions Inc. and Burlington Electricity Services Inc. to pilot a nano-grid EV charging solution for both commercial and residential use.

Vehicle and Charging Technology Innovators

Daymak (Toronto): Develops light EVs and patented wireless charging technology (Ondata).

PowerON Energy Solutions (Toronto): A subsidiary of OPG that specializes in electrifying transportation fleets. It provides turnkey EV charging infrastructure and energy solutions for transit agencies and commercial operators, helping accelerate Ontario's shift to clean, electric mobility.

Verdyn (Toronto): An energy solutions company specializing in advanced EV charging and power systems. It delivers innovative, resilient infrastructure for clean energy and grid integration, focusing on remote and industrial applications. With OVIN support, Verdyn is collaborating with Thinking Capital to develop and demonstrate an innovative DC fast-charger that combines solar generation, an energy storage solution, and a DC microgrid within a single enclosure.

Soneil Spark (Brampton): Offers a suite of smart, scalable charging technologies, including modular Level 3 chargers and mobile EV charging trailers. Soneil Spark is advancing EV infrastructure for residential, commercial, and remote applications. With OK Tire and OVIN support, Soneil Spark is designing a grid load-balancing system that enables more efficient use of existing electrical infrastructure, helping businesses deploy EV charging without costly and time-consuming power upgrades.

Variablegrid (Toronto): Specializes in EV Energy Management Systems for multi-residential and home charging. With Hypercharge Networks, Leading Ahead Inc., and OVIN support, Variablegrid is developing an energy management platform that dynamically controls EV charging and enables multi-tier power coordination and V2G functionality.

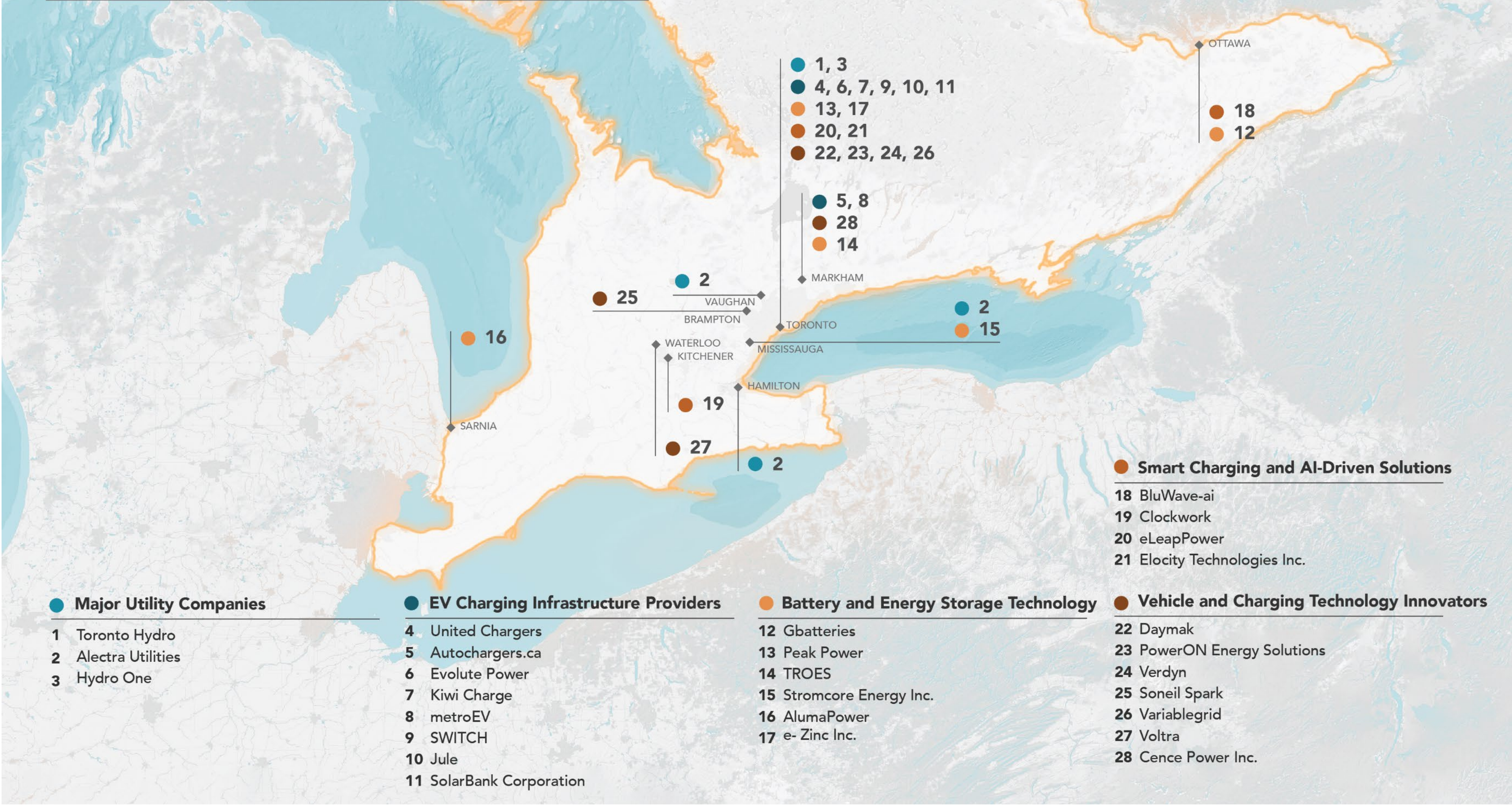
Voltra (Waterloo): A startup developing modular, API-driven software to modernize EV infrastructure and distributed energy systems. Its flagship platform, Charge, enables real-time, scalable control of EV charging networks, helping utilities and operators manage demand, enhance reliability, and extend the life of existing infrastructure.

Cence Power Inc. (Markham): Specializing in the commercialization of an easy-to-deploy DC power distribution system, Cence Power Inc. is developing a 12kW Class 4 fault-managed power system to revolutionize Level 2 EV charging infrastructure by eliminating the need for traditional AC wiring, mechanical protection, and conduit.

This project aims to enhance the scalability, cost-effectiveness, and flexibility of EV charger installations, particularly in commercial settings where electrical panels are often located far from parking areas. Unlike conventional Level 2 chargers that require 240V AC wiring, Cence Power Inc.'s system delivers 400V DC directly to the charger, reducing installation complexity and allowing the use of thinner gauge copper wiring, significantly lowering material costs and environmental impact. The system incorporates advanced fault detection and rapid power shutoff to ensure safety while maintaining the high efficiency of direct DC power distribution.

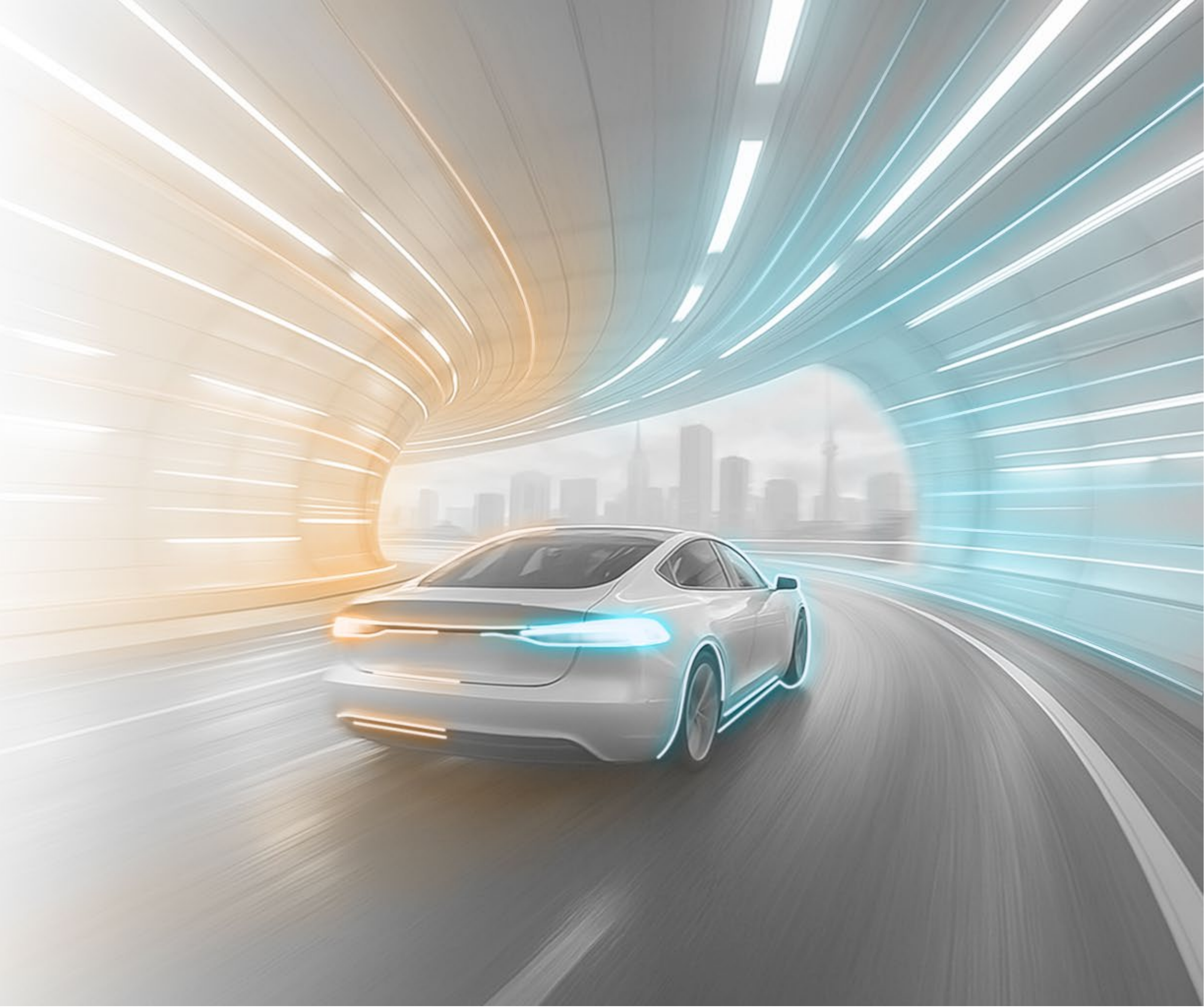
This project is intended to advance the technology from a working proof-of-concept to a fully UL Certified system, validated through pilot installations in Ontario. By reducing the labour and materials required for EV charger installations, the solution supports the widespread adoption of electric vehicles while enhancing Ontario's leadership in clean energy innovation. The project will create high-skilled jobs in Ontario's clean technology and energy sectors, strengthen local manufacturing partnerships, and contribute to the province's goals by accelerating the transition to more efficient EV charging infrastructure.

Key Players in Ontario's EV Charging Infrastructure Ecosystem



5. Opportunities for Ontario

As Ontario accelerates its shift to EVs, the province has a key opportunity to build a more equitable, efficient, and future-ready EV charging network. While programs like EV ChargeON and the EVCCP have laid a strong foundation, the next phase must address gaps in access, streamline deployment, and unlock new value from emerging technologies. This chapter explores opportunities to expand charging in multi-unit buildings, strengthen rural and remote networks, integrate smart charging and V2G, simplify permitting, and enable market participation for aggregated EVs – laying the groundwork for a connected, intelligent, and inclusive EV ecosystem.



5.1 Establish a Provincial EV Charging Infrastructure Strategy to Guide and Align Existing Initiatives

Developing a targeted EV charging infrastructure strategy presents a major opportunity for Ontario to lead in the clean transportation transition while addressing key challenges in grid capacity, urban planning, and equitable access. Experts note the value of a strategy for long-term planning and commercial commitments. A well-defined strategy could provide a roadmap for coordinated investment, streamline permitting and deployment, and ensure that infrastructure keeps pace with rising EV adoption. Experts emphasize the importance of making deployment strategies grid-friendly and focusing on solutions that consider the grid in addition the end user.

An EV charging infrastructure strategy designed for Ontario can be especially important for high-density areas and MURBs. A strategy can also support Ontario's landscape of decentralized utility distribution – the province is currently home to 59 distributors. This ecosystem can lead to smaller utilities having less resources to tackle EV charging head on. Experts point to integrating communication between LDCs as one part of streamlining the EV charging infrastructure ecosystem.

Specifically focusing on EV charging infrastructure could also be particularly beneficial in reducing costs. It could help align public and private sector efforts, reduce duplication, and unlock funding more effectively. To maximize investments, experts stress the importance of considering infrastructure interoperability in addressing EV charging expansion, especially to ensure reliability for customers and provide a clear path for LDCs and their participation in the EV charging industry. Experts also note the significant differences in the charging needs of passenger vehicles and larger trucks and depots with fleets of EVs. Both require consideration for effective EV charging infrastructure strategy.

Importantly, Ontario's strategy also must distinguish between general EV charging infrastructure and the unique requirements of Level 3 fast charging. Fast chargers – critical for long-distance travel, commercial fleets, and high-turnover urban areas – require significantly more power, more robust grid connections, and different siting considerations than Level 1 or 2 chargers. Without a targeted approach, there could be a risk in under-serving key use cases and missing opportunities to accelerate EV adoption in high-impact sectors.

Ontario can draw inspiration from global leaders. The EU's AFIR regulation mandates fast-charging stations every 60 kilometers along major corridors, backed by clear technical standards and timelines. This has paved the way for accelerated deployment and interoperability across member states. Meanwhile, China's national strategy has enabled it to develop world leading EV charging infrastructure through strong central planning, urban integration, and innovation in battery swapping and smart grid technologies. Some experts also recommend referencing open EV charging standards to improve interoperability and to help ensure EV charging infrastructure investments are future-proof.

5.2 Expanding EV Charging Access in Multi-Unit Residential Buildings

As EV adoption accelerates in Ontario, ensuring equitable access to charging infrastructure in MURBs is becoming increasingly important. A significant portion of Ontarians live in condos and apartment complexes, where installing personal EV chargers can be technically challenging and financially burdensome. Experts also note issues with grid capacity in these areas and additional challenges when retrofitting MURBs for EV charging.

To address this, the province could introduce targeted incentives to support retrofitting existing MURBs with EV charging infrastructure. These incentives could help cover the costs of electrical upgrades, charger installation, and permitting, while also offering technical guidance to property managers and condo boards navigating the process. In parallel, Ontario could take proactive steps to future-proof new developments by mandating EV-ready infrastructure in all new MURBs province-wide, as is already done in Toronto via the Zoning Bylaw 569-2013. Municipalities could also be encouraged to adopt complementary zoning bylaws that support EV infrastructure in high-density areas.

To address the unique challenges of urban environments, where parking is limited and shared, Ontario could support pilot programs for shared or smart charging solutions. These programs could explore innovative models such as communal charging hubs, time-based access systems, and smart load management technologies that allow multiple users to share a single charger efficiently. By partnering with utilities, technology providers, and local governments, the province can test scalable solutions that make EV charging more accessible in dense residential settings, helping to close the infrastructure gap for urban dwellers.

5.3 Continuing to Encourage Industry, Government, and Academic Collaboration

Innovative and smart EV charging technology is critical to enabling robust and forward-looking grid readiness. With stakeholders across generation, transmission, distribution, retail, and EV charging, continued strategic collaboration between government entities, academic institutions, and the EV charging industry is key. Each stakeholder contributes distinct expertise and resources and plays an important role in Ontario's electricity grid. Ontario is already demonstrating leadership through examples like the IESO GIF. OVIN also provides space for creating connections through its range of programs, including the R&D Partnership Fund, OVIN Incubators, and RTDS network.

Academics across the province are demonstrating valuable findings for governments and industry. For example, Ontario Tech University is home to Smart Transportation Electrification and Energy Research, a group leading research and development on wired and wireless chargers, energy storage systems, and electric motor drives for EVs with government support and industry partners. The Canada Excellence Research Chair Laureate Program at McMaster Automotive Resource Centre, located at McMaster University, is another example. Research is focused on electrified vehicle research, including charging, V2X, energy management and storage systems, and power electronic EC/EC converters.

A multidisciplinary approach fosters an integrated ecosystem that enhances grid resilience, enables scalability, and supports the broader transition to a sustainable, electrified mobility network. Experts also note that further collaboration could be beneficial to utilities looking for dependable opportunities to access and use new technologies without compromising grid operations.

Experts have also noted the significant value funding opportunities like grants to enable the pursuit of innovation and in providing space for industry, regulatory bodies, and utilities to explore new technologies together. Incentives can promote motivation to pursue innovations and make improvements in positive spaces, which can increase cost competitiveness and the emergence of new technologies and solutions for the benefit of both consumers and the grid.

5.4 Strengthening Rural and Remote Charging Networks

Ensuring equitable access to EV charging infrastructure across Ontario means addressing the unique challenges faced by rural, northern, and Indigenous communities. Ontario should continue to expand targeted funding for public charging stations in underserved regions. Strengthening rural charging networks is also essential to resolving range anxiety, a key barrier to EV adoption, and enabling long-distance travel across the province and beyond.

Collaboration with local utilities, energy co-operatives, and community organizations is essential to identifying high-impact locations for new chargers. These stakeholders have deep knowledge of local travel patterns, grid capacity, and community needs. By working together, the province can ensure that infrastructure investments are both technically feasible and socially beneficial. In especially remote or off-grid regions, Ontario could explore innovative charging solutions such as mobile charging units, solar-powered stations, or battery-buffered systems that do not rely on full grid connectivity. Pilot programs could test these models in partnership with Indigenous communities and clean tech providers, helping to build local capacity while ensuring that no region is left behind in the EV transition.

5.5 Integrating Smart Charging and V2G Technologies

Integrating smart charging and V2G technologies presents a major opportunity to enhance grid efficiency, reduce energy costs, and support a more resilient electricity system. Experts noted the importance of leveraging smart technologies, data, and collaboration between industry and utilities to ensure that growing EV charging and electricity demand can be met through optimized capacity and generation.

Smarter EV charging and grid solutions can support more efficient utility use. Operating peaker plants during events like heat waves is costly as they are paid to both maintain capacity and to operate intermittently. Additionally, as peaker plants are low use and high-emitting, generally natural gas powered, limiting their use also supports decreasing emissions. Adding generation capacity also requires significant financial investment, with projects taking years to complete.

Smart technologies can help flatten peak demand, reduce strain on the grid, and improve the integration of intermittent renewable energy sources. Experts note that a current gap in bidirectional charging is the lack of consideration from major companies when procuring large EV fleets, where many have yet to leverage the technology. To unlock these benefits, Ontario can continue to support pilot projects that test V2G and smart charging in diverse settings such as commercial fleets, workplaces, and residential neighborhoods. For example, school bus fleets or delivery vehicles that are parked for long periods could serve as ideal candidates for V2G trials. These pilots would help identify technical, economic, and behavioural barriers while generating valuable data to inform broader deployment.

In parallel, the province could work with the energy regulators and other stakeholders to develop clear standards and regulatory frameworks for bidirectional charging. This includes defining interconnection requirements, safety protocols, and compensation mechanisms for energy fed back into the grid. Finally, Ontario can continue to offer dynamic pricing or demand response programs that reward EV owners for charging during low-demand periods or reducing load during peak times. These programs, when paired with smart chargers, can automate energy use in ways that benefit both consumers and the grid. Experts note that by aligning financial incentives with grid needs, Ontario can accelerate the adoption of intelligent charging technologies while supporting its broader decarbonization and electrification goals.

5.6 Streamlining Permitting and Interconnection

While the EVCCP has laid important groundwork for standardizing the installation and grid connection of EV chargers, further streamlining is essential to accelerate deployment and reduce administrative bottlenecks. One key opportunity is the creation of a centralized digital permitting platform that allows developers, municipalities, and utilities to manage applications, approvals, and inspections in one place. Such a platform could include real-time status tracking, document uploads, and automated notifications, significantly reducing delays and improving transparency across the permitting process. In addition, the province could offer technical assistance and capacity-building support to municipalities and smaller utilities that may lack the resources or expertise to efficiently process EV charging applications.

In Ontario, the typical timeline for connecting a new facility to the grid is between 3-5 years with the process being divided into six stages. The province's new Integrated Energy Plan calls for a review of grid-connection procedures and timelines, and the consideration of performance standards for the agencies involved. Early steps are underway: in 2024, the OEB introduced a standardized EVCCP for all local utilities, replacing a patchwork of 58 different processes with one clear timeline and set of requirements for connecting public EV chargers. This would provide clarity and predictability for developers and utilities alike, helping to align expectations and reduce project uncertainty. Experts further note the value of focusing on streamlining interconnection processes to accelerate EV charging infrastructure deployment.

5.7 Enabling Market Integration of EVs Through Aggregation and Regulatory Reform

Looking ahead, one of the most transformative opportunities for Ontario's EV ecosystem lies in market integration, specifically, enabling aggregated EVs or third-party aggregators to participate in the IESO-administered electricity markets. This would allow fleets of EVs to act as DERs, providing services such as capacity, frequency regulation, and demand response. In the United States, Federal Energy Regulatory Commission Order 2222 is already driving this shift by requiring grid operators to allow aggregated DERs to compete in wholesale markets. Ontario is laying similar groundwork through the IESO's DER Market Vision and Design Project.

The IESO's DER roadmap outlines a goal to introduce expanded wholesale market participation models by 2026, enabling DERs, including EVs, to provide the services they are technically capable of delivering. This includes the development of new participation models, operational coordination protocols between the IESO and LDCs, and frameworks for enabling non-wires alternatives. These efforts are essential to unlocking the full value of EVs as grid assets, especially as the number of vehicles and their collective storage capacity grows. In the near future, it is plausible that an aggregator managing 10K EVs could bid a megawatt-scale reduction into a capacity auction or provide frequency regulation by modulating charging patterns in real time.

To make this possible, Ontario will need to establish clear regulatory frameworks for aggregation. It will also require coordination between the IESO, the OEB, and utilities to ensure that aggregated EVs can participate without compromising grid reliability or customer privacy. By treating EVs not just as transportation assets but as active grid participants, Ontario can unlock new revenue streams to incentivize EV owners to participate in supporting the grid, improve grid flexibility, and reduce the need for costly infrastructure upgrades. This shift would mark a major milestone in the province's energy transition.

5.8 Supporting Consumer Confidence Through Data-Driven Solutions

Although the number of public chargers installed is usually known, data on how well they function or insights on charger uptime is lacking. While early EV adopters may accept occasional charging failures, ensuring that charging is reliable and user-friendly is essential to building trust and encouraging broader consumer transition. While user error is a common cause of failed charging attempts, technical issues such as vehicle compatibility problems or backend system faults also contribute. Environmental conditions, particularly extreme weather in regions like Canada, can further impact vehicle efficiency and energy demand, thereby shaping usage patterns.

Experts have noted the importance of capacity intel in ensuring effective and reliable charging networks, especially in urban settings. Leveraging the incoming online interactive capacity maps from the utilities across Ontario will be a significant support for reliable electrification, including EV charging, in the province. Experts note that this kind of information will also support foreign direct investment by providing clear and accessible data, allowing the EV charging infrastructure ecosystem to grow to meet customer needs.

5.9 Continue Shaping a Workforce for the Future and the Now

As Ontario continues to position itself as a leader in the electrification of transportation, the development of a skilled and future-ready workforce is both a strategic necessity and a significant opportunity. Workforce development is not only about preparing for the future; it is also about meeting the immediate needs of a rapidly evolving industry. Experts note the importance of ensuring that the youth of today are equipped with the skills to understand and use emerging technologies, which will be especially critical for maintaining and building job opportunities within the province. It can also support Ontario in becoming a leader in EV charging infrastructure manufacturing and exports. OVIN's Talent Strategy & Roadmap plays a central role in this effort. As a province-wide initiative, it aligns workforce development with the evolving needs of the automotive and mobility sectors, ensuring that Ontario's talent pipeline is responsive to industry transformation. By identifying key skills gaps and future opportunities, the roadmap supports strategic planning across education, training, and employment, helping to build a resilient and competitive workforce that can meet the demands of electrification and smart mobility.

Experts note the real-life success of workforce programs like OVIN's Talent Development program, which can make a significant difference for organizations looking to hire interns and fellows to directly contribute to their businesses and projects. Such programs provide valuable support for transitioning into the workforce, which can be a challenge for both employees and employers. Ensuring early career Ontarians have access to post-academia opportunities can also support retention in the province, building local economies and growing industries within Ontario. Experts point to workforce retention as a key for the province and recommend highlighting advantages outside of financial incentives that make Ontario a great place to live and work. Creating a compelling narrative around living and working in Ontario can help build a resilient and committed workforce.

Skills and knowledge are needed across both the current and future workforces. For supporting those coming into the field, experts recommend that universities consider expanding current academic options and offering further educational opportunities for grid-related topics like smart grids and technologies like BESS. Ontario's opportunity lies in its ability to proactively shape a workforce that is both responsive to today's needs and prepared for tomorrow's challenges. Through continued support in education, training, and retention, the province can solidify its leadership in electrification and become a global hub for EV charging innovation.

6. Glossary

AC	Alternating Current
AFC	Alternative Fuel Corridors
AFIR	Alternative Fuels Infrastructure Regulation
AI	Artificial Intelligence
AMI	Advanced Metering Infrastructure
AV	Autonomous vehicle
BESS	Battery Energy Storage System
BEV	Battery Electric Vehicle
BTM	Behind-the-Meter
CaaS	Charging-as-a-Service
CCS	Combined Charging System
CER	Clean Electricity Regulations
CFI	Charging and Fueling Infrastructure
CHAdeMO	Charge de Move
DC	Direct Current

DER	Distributed Energy Resources
DERMS	Distributed Energy Resource Management Systems
EU	European Union
EV	Electric Vehicle
EVCCP	Electric Vehicle Charging Connection Procedure
EVID	Electric Vehicle Infrastructure Demonstration
FIT	Feed-in-Tariff
GIF	Grid Innovation Fund
ICE	Internal Combustion Engine
IEA	International Energy Agency
IESO	Independent Electricity System Operator
kV	Kilovolt
kVA	Kilovolt-Ampere
kW	Kilowatt
kWh	Kilowatt Hours
LDC	Local Distribution Companies
MDM/R	Meter Data Management/Repository

MURB	Multi-Unit Residential Buildings
MVA	Mega Volt-Ampere
MW	Megawatt
NACS	North American Charging System
NEVI	National Electric Vehicle Infrastructure
NRCan	Natural Resources Canada
OCPI	Open Charge Point Interface
OEB	Ontario Energy Board
OPG	Ontario Power Generation
OZEV	Office for Zero Emission Vehicles
PCPR	Public Charge Point Regulations
PHEV	Plug-in Hybrid Electric Vehicle
RTDS	Regional Technology Development Site
SaaS	Storage-as-a-Service
TEN-T	Trans-European Transport Network
TOU	Time-of-Use
TTC	Toronto Transit Commission

TWh	Terawatt-hours
UK	United Kingdom
ULO	Ultra-Low Overnight
VPP	Virtual Power Plant
V2B	Vehicle-to-Building
V2G	Vehicle-to-Grid Both Ways
V2H	Vehicle-to-Home
V2L	Vehicle-to-Load
V2V	Vehicle-to-Vehicle
V2X	Vehicle-to-Everything
ZEV	Zero-Emission Vehicle
ZEVIP	Zero Emission Vehicle Infrastructure Program

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8. Disclaimers

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