Electric Vehicle Readiness Plan

for the Rockford Region

Technical Memorandum #1

Research & Best Practices

October 2020

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This document has been prepared by the Region 1 Planning Council in collaboration with its member agencies, partnership organizations, and local stakeholders.

This report was prepared in cooperation with the following:

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The contents, views, policies, and conclusions expressed in this report are not necessarily those of the above agencies.

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Introduction

The future of transportation is increasingly moving towards cleaner, more efficient fueling systems and infrastructure. These alternative fuel sources, such as hydrogen, biodiesel, and electric, provide a higher level of efficiency and contribute to lower emissions in comparison to traditional fuel sources, such as gas and diesel. While electric vehicles (EV) still represent a comparatively small margin of new vehicle sales, less than 2 percent of the overall market share, sales year-over-year continue to climb, with more than 358,000 sold nationally in 2018.[i] This increase reflects a consumer market shift towards EV acceptance. Despite the rise in sales nationally, the consumer attitude towards EVs remains hesitant, which hinders broad acceptance and wide-spread integration.

According to an October 2019 survey report, completed by AlixPartners, consumers' largest concerns surrounding EVs were related to cost, battery range, and charging infrastructure[ii]. Further, according to a January 2019 report completed by the International Council on Clean Transportation (ICCT), there is currently a national shortage of necessary infrastructure related to EVs. To meet demand, infrastructure needs to be expanded by about 400 percent in the most populous metropolitan areas, greater than 50,000, by 2025.[iii] The ICCT report recommends a comprehensive approach to planning, programming, funding, and implementing EV systems and infrastructure. Subsequently, despite a noticeable consumer market shift towards a broader acceptance of EVs as an alternative fuel source for transportation, considerable amount of work is needed at the national, state, and local levels for broad EV integration in the United States.

Electic vehicles are being driven throughout the United States in increasing numbers, and the battery-charging infrastructure that supports them is being deployed with different location specifications, business models, technology configurations, and utility communication networks.[iv] Each state and local jurisdiction will need to consider a full scope of regulatory measures, public-private partnerships (P3s), and technological upgrades for the anticipated growth in the EV sector.

Region 1 Planning Council, acting as the Metropolitan Planning Organization (MPO) for the Rockford Region, has developed an Electric Vehicle Readiness Plan focusesd on preparing the region for the increased adoption of EVs and the supporting infrastructure required. This plan was identified as a regional need through the update of the 2050 Metropolitan Transportation Plan (MTP), adopted in July 2020 and aligns with goals and objectives identified in the Illinois Department of Transportation's (IDOT) Long Range Transportation Plan (LRTP), as well as direction from the Federal Highway Administration (FHWA), Federal Transit Administration (FTA), and U.S. Department of Energy (DOE).

Through the final report, the region can plan for appropriate future infrastructure investment, both public and private, and identify needed policy changes that will allow for a robust charging network. An improved regional charging network would enable EV owners and local communities to accomplish the following:

- Charge at home, work, in commercial locations, and at public charging facilities;
- Ease consumer concerns, such as range anxiety through expanding charging infrastructure availability;
- Better integrate EVs into regional transportation networks;
- Encourage widespread EV adoption in public and private sectors; and
- Have regionally consistent goals and objectives.

To achieve these goals, the development process for this plan has been divided into the following three key phases.

The first phase of this planning process was dedicated to researching best practices and national trends. Research conducted included identifing the types of electric vehicles available on the market and the associated electric vehicle supply equipment needed to fuel them, as well as the existing national, state, and local programs supporting electric vehicles. Following this initial research, staff conducted a nationwide scan for best practices of how local governments have incorporated provisions in their zoning ordinances, building codes, and parking ordinances related to EV charging. This research was completed in Summer 2020 and is highlighted further within this technical memorandum.

The second phase is focused on the local perspective on electric vehicles and how ready local governments are to address EV trends. A two-prong approach was taken for this phase of the development process. First, a survey was posted online to gauge public opinion on the likelihood of owning an electric vehicle and some of the reasoning behind their apprehensions in purchasing an EV, as well as some of the challenges current EV owners face within the region. Second, RPC staff meet with various county and municipal staff to discuss their jurisdiction's approach to planning for electric vehicles both within their codes and ordinances, as well as their considerations for electric vehicle fleets. The results of this phase have been summarized in Technical Memorandum #2: Public & Stakeholder Engagement.

The third and final phase of the Electric Vehicle Readiness Plan consisted of setting the regional goals and targets aimed at becoming a more EV-ready region and drafting the final plan. The resulting plan provides partners with the tools needed to accomplish the set goals and targets. These tools include draft language and processes for zoning ordinances, residential and commercial building codes, permitting, and parking regulations, as well as a draft sole source procurement process to further coordination between all jurisdictions. Additionally, the plan includes a deployment map with key locations for publicly accessible EV charging infrastructure and identifies several funding sources that may be able to be utilized moving forward.

Electric Vehicle Background

Electric Vehicles

Electric vehicles and alternative fuel infrastructure are rapidly developing fields that have the ability to dramatically alter the current transportation system. This section describes the difference between various alternative fuel vehicles types and their applications in the field to date. The sections are broken out between light-duty vehicles, such as cars or SUVs, and medium-to-heavy-duty vehicles, such as buses or delivery vans.

Light-Duty Vehicles

The term electric vehicle encompasses several different types of vehicles, including hybrid electric vehicles, plug-in hybrid electric vehicles, and battery electric vehicles, also referred to as a plug-in electric vehicle. Table 2-1 provides a high-level overview of each of type of vehicle.

Hybrid electric vehicles (HEVs) supplement the internal combustion engine (ICE) used in gasoline vehicles with electrical power produced by an on-board electric motor. The electrical system acts as a generator when a driver applies the brakes, converting kinetic energy into electrical energy that is stored in a small battery pack; gasoline or diesel are still the primary fuels.

A plug-in hybrid electric vehicle (PHEV) is an HEV with a larger battery that plugs in to charge, but keeps a gasoline or diesel engine as a backup. Some variations are called extended range electric vehicles (EREVs). After the battery energy is exhausted, the engine starts and the vehicle acts like a normal HEV until it is charged again from the electric grid. BEVs fully remove the gasoline or diesel powertrain and replace it with an electric powertrain consisting of an electric motor, power electronics, and a battery pack. When running on electricity, EVs are able to completely eliminate tailpipe emissions.

Battery electric vehicles (BEVs) have a longer all-electric range than PHEVs, but do not have a fuel backup when the battery is depleted. Using electricity as a vehicle's only fuel option is currently less expensive per mile than gasoline, and can be more cost effective if the EV driver takes advantage of off-peak electricity rates.[1] As of 2020, BEVs can travel, on average, between 60 and 265 miles on a single charge and take at least 30 minutes to recharge the battery. An average gasoline vehicle will be able to travel 300 to 500 miles on a single tank and can fuel in less than five minutes. Fear due to differences in vehicle range on a single tank or "range anxiety" can often be solved with careful planning, such as plugging in every night and identifying charging stations along a route, or through the purchase of a PHEV to have a gasoline engine in reserve. PHEVs have ranges similar to gasoline vehicles, but typically only run on electricity for the first 10 to 50 miles.

Currently cold and hot ambient temperature conditions will impact the driving range of EVs due to added power requirements to heat or cool the interior, thus decreasing the performance of the batteries. While manufacturers continue to improve the vehicle's performance for adverse climates, a decrease in electric mileage by up to 50 percent on the coldest days and 20 percent on the hottest may occur.

Medium-to-Heavy-Duty Vehicles

Electric vehicles are available for use in applications other than passenger vehicles, such as transit buses, long-haul trucking, and refuse vehicles. Similar to light-duty EVs, electric-trucks (e-trucks) and buses come with different levels of electrification within vehicle type, as shown below in Table 2. Due to more specific applications of EVs in the medium-to-heavy-duty vehicles, the varied ranges of PHEVs and BEVs are listed in Table 2-2.

One vehicle electrification model cannot fit all of the applications for the truck and bus market. Some of the different applications where EVs are in use are:

- Transit buses;
- Refuse (garbage, recycling) trucks;
- Delivery vans;
- Shuttle buses; and
- Utility and work trucks.

Similar to light-duty EVs, within medium-to-heavy-duty vehicles, PHEVs provide zero-emission miles, operational flexibility, and require charging infrastructure that is often simpler and easier

EV Charging Station at the Machine Shed. Rockford, IL.

1 Currently, there are three rate options available to ComEd residential customers: ComEd's fixed-price rate (BES), ComEd's hourly pricing rate (BESH) and a delivery services rate (RDS).

to install. Short -range BEVs can be charged quickly to operate without long interruptions for charging, while long-range BEVs have higher vehicle assignment flexibility, as these vehicles are not limited to on-route charging infrastructure. Each level of vehicle electrification has its place in the current e-truck and bus market. Industry stakeholders are working together to facilitate the electrification of trucks and buses without choosing a specific technology and stifling market innovation.

All e-trucks and buses will require the installation of charging infrastructure that could potentially impact the grid due to higher electric needs. Selecting one technology over another involves trade-offs between specific vehicle operation requirements, power demand on the grid, and operational savings. The balance between standardization and innovation will have to be addressed in developing uniform regional infrastructure recommendations. Flexible codes with clear goals for the region can allow industry stakeholders to choose the best technology for their specific needs while moving toward a regional target of electrification.

Public Transit Agencies

Within the medium-to-heavy-duty vehicles category, the publicly-funded transit bus sector offers an ideal platform for the validation and early adoption of advanced vehicle technologies. Public transit operations are well suited to alternative fuel use. Transit vehicles often travel on contained routes with centralized fueling, serviced by a team of consistently-trained technicians, and are a

Table 2-1. Light-Duty Electric Vehicle Characteristics

Vehicle Type	Description	Examples
Hybrid Electric Vehicle (HEV)	HEVs are powered by an internal combustion engine and by an electric motor that uses energy stored in a battery. The battery is charged through regenerative braking and by the internal combustion engine and does not plug in to charge.	Toyota Prius Hybrid Honda Civic Hybrid
Plug-In Hybrid Electric Vehicle (PHEV)	PHEVs are powered by an internal combustion engine and an electric motor that uses energy stored in a battery. The vehicle can be plugged in to an electric power source to charge the battery. Some can travel nearly 100 miles on electricity alone, and all can operate solely on gasoline (similar to a conventional hybrid)	Chevrolet Volt Chrysler Pacifica Kia Optima
Battery Electric Vehicle (BEV)	BEVs use a battery to store the electric energy that powers the motor. A BEV does not have an ICE. BEV batteries are charged by plugging the vehicle in to an electric power source. The range of a BEV on a full charge can be over 300 miles, depending on the model.	Nissan LEAF Tesla Model 3 Chevrolet Spark

Source: U.S. Department of Energy. Alternative Fuels Data Center.

Table 2-2. Medium- to Heavy-Duty Electric Vehicle Characteristics

Vehicle Type	Example	Average Peak Demand	Battery Size
Short Range Plug-In Hybrid Vehicle	Volvo PHEV Class 8 Drayage Truck	10 kW	10 kWH
Work Truck Plug-In Hybrid Vehicle	Odyne Advanced Diesel PHEV Truck	3.3 kW	14/28 kWh
Long Range Plug-In Hybrid Vehicle	Efficient Drivetrain PHEV/CNG Class 4 Truck	up to 6.6 kW	40 kWh
Short Range Battery Electric Vehicle	Proterra Fast Charge Catalyst	280 to 380 kW	53 kWh 131 kWh
Mid-Range Battery Electric Vehicle	Transpower Electric Drayage Drive	70 kW	215 kWh
Long Range Battery Electric Vehicle	BYD 40-ft Electric Transit Bus	Option 1 - 8 kW Option 2 - 200 kW	324 kWh

Source: EVS29 International Battery, Hybrid and Fuel Cell Electric Vehicle Symposium, World Electric Vehicle Journal Vol. 8

part of high mileage fleets, all of which can add up to favorable economies of scale. Additionally, transit agencies also typically operate in urban areas that may have air quality concerns. Alternative fuel transit vehicles offer substantial improvements in emissions, including reducing visible soot and often operate more quietly.

Electric drive and electric-assisted buses already have a foothold in the nation's public transit industry and this trend is continuing to grow. According to the American Public Transit Association's (APTA) Public Transportation Vehicle Database, alternative fuels (biodiesel, hydrogen, electric, propane, etc.) and hybrid drivetrains powered more than half of all transit buses in 2017 and 2018. This is up from 2014, when 17 percent of the U.S. fleet was alternative-fuel powered.

Regionally, Rockford Mass Transit District (RMTD) has begun the process of converting their bus fleet to alternative-fueled vehicles. In 2019, RMTD placed their first order for five diesel hybrid-electric buses as replacements for past-useful life diesel vehicles. The initial conversion from diesel to diesel-hybrids will provide RMTD time to analyze and test needed utility infrastructure improvements required to power a fully alternative-fueled fleet while slowly absorbing the higher initial-price tag of alternative-fueled buses over the next decade. Should funding or grant opportunities become available, RMTD expects a future desire to purchase battery electric buses (BEB) over hybrid-electric buses.

There are also ongoing conversations between other public agencies and RMTD to continue innovating and improving the regional transportation network. An example of this is the recent joint Better Utilizing Investments to Leverage Development (BUILD) grant application in 2019 and 2020. The City of Rockford (COR), in partnership with RMTD, requested funding for Phase 1 of the Downtown Rockford Complete Streets Revitalization Project. Along with "complete street" reconstruction of several one-way pairs, funding was requested for the capital purchase of three electric buses, bus-charging infrastructure, and passenger amenities.

Electric Vehicle Charging Infrastructure

Charging equipment for EVs, also called electric vehicle supply equipment (EVSE), is available at various levels based on the rate at which the battery is charged. The time needed to fully charge an EV will vary based on the size of the vehicle's battery, how depleted it is, and the electric current of the charging equipment. There are also different needs for light-duty vehicle applications versus medium-to-heavy-duty applications.

Light-Duty Vehicle Charging

Light-duty EV users have the flexibility to charge at a variety of locations, including home, work, and other destinations, such as shopping centers, restaurants, and fleet parking facilities. Table 2-3 provides an overview of current EV charging levels, including the amount of range each level provides, the connector types used, and typical applications.

Types of locations at which electric vehicle charging typically occurs are:

- **Residential:** A single-family home, apartments, or condos; usually within a garage and allows individuals to take advantage of low, stable residential electricity rates;
- **Workplace:** A place of employment; usually in a private lot or garage that allows employees to take advantage of free charging while at work;
- **Public:** Stations open to the public, usually located in areas with a high vehicle concentration such as shopping centers, parking garages, public lots, or airports. While these charging units allow consumers to take advantage of conveniently located parking, they are often set up through a pay-for-use system, similar to traditional public parking; and
- **Fleet:** At stations or facilities that are owned by private or public entities with large numbers of vehicles which need to be charged simultaneously, and are not generally open to public use, such as municipalities, car rental companies, or rideshare companies.

Table 2-3. Light-Duty Electric Vehicle Charging Characteristics

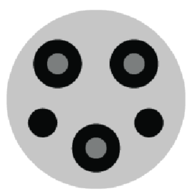
Type	Electric Current	Charging Rate	Connector(s)	Primary Use
Level 1	Alternating Current (AC) 120 volt (V), 20 amp (a)	2-5 miles of range per hour of charging	J1772	Residential Workplace Fleet
Level 2	AC 208/240V, 30A	10-20 miles of range per hour of charging	J1772	Residential Workplace Fleet Public
DC Fast Charge	Direct Current (DC) 208/480V, 80-200A (and higher)	60-80 miles of range per 20 minutes of charging	J1772 Combo (CCS) CHAdeMO Tesla	Fleet Public

Source: U.S. Department of Energy. Alternative Fuels Data Center.

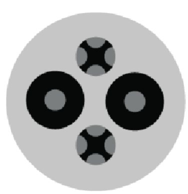
Approximately 80 percent of EV charging occurs at home, where charging is the most convenient and cost-effective. However, there are some challenges with charging infrastructure at multi-family developments, including access to reliable parking, billing, sufficient power supply, and ownership. As of 2020, EVSE standards have not been set in Illinois for multi-family dwelling units. Workplace charging also provides an opportunity for the region, as it increases the convenience for employees and increases the ability of users without access to home charging to utilize EVs. This service can provide an incentive for potential EV users and decreasing range anxiety.

Dwell time is the amount of time a vehicle is typically parked.

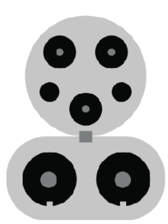
Figure 2-1. Types of Charging Ports



J1779 Charge Port



CHAdeMO



CCS Charge Port

Tesla

Source: U.S. Department of Energy. Alternative Fuels Data Center.

Access to public charging is a key factor in decreasing range anxiety and increasing charging convenience in the region. For all charging applications, dwell time (or the amount of time a vehicle is typically parked) should be considered when determining what charging level to install. A more in-depth look at different charging infrastructure can be seen in Figure 2-2.

The cost of EV charging infrastructure varies based on charging efficiency, the number of connectors, type of mounting (wall or pedestal), and networking and communication capabilities. Typically, before incentives and installation costs, the price of Level 1 charging equipment can range from $300-$1,500 per unit, Level 2 equipment can range from $400-$6,500 per unit, and DC fast infrastructure can range from $10,000-$40,000 per unit. Installation costs can also vary depending on the number of EV chargers installed, indoor versus outdoor installation, and electrical upgrades required. Installation costs alone can range from $0-$51,000 per charging unit.

Charging station costs vary widely, primarily depending on where the infrastructure is installed. Stations in parking garages are relatively straightforward and the majority of installation costs are for electrician labor. Charging stations in parking lots may require trenching and boring, which can drastically increase installation costs. This is where partnerships can play a role assisting in the infrastructure installment. Through partnerships between electric companies and other entities there can be cost sharing and consolidation of work to provide more efficient and less expensive installations. DC fast charging stations often need electrical upgrades to provide the site with enough power, this may align with the goals of electric companies and can be addressed in a joint approach. Municipalities can also work with other entities to provide easier permitting and processes that streamline the ability to install charging stations.

Medium-to-Heavy-Duty Vehicle Charging

While charging for e-trucks is currently in development, electric transit bus technology has been widely implemented. In the United States, battery electric buses (BEBs) are typically charged through three methods, plug-in charging, overhead conductive charging, and wireless inductive charging. While plug-in charging is the least expensive of the three methods, according to a 2018 report by the Transportation Research Board (TRB). The report found that half of the surveyed agencies use on-route overhead conductive chargers. Although limited information is available, plug-in charging has been reported to cost $50,000 and overhead DC fast charging has been reported to cost $665,000 on average. Average descriptions of the charging types are listed below.

A more complete study of pros and cons of different charging types can be found in the Battery Electric Buses State of the Practice (2018) by the Transit Cooperative Research Program.

- Plug-in charging:
  - Manually plugging in the vehicle to a power supply.
  - Installed at the depot, shop, or garage.
  - Used to charge overnight.
  - Used as a sole charging method for buses with large battery packs and higher range.
- Overhead conductive charging:

Figure 2-2. Levels of Charge: Diagrams & Attributes

Level 1

Attributes

- A standard outlet can potentially fully recharge an EV battery in 8-12 hours through larger batteries, such as the Tesla Model S, would require between 1 and 2 days.
- This level is often sufficient for overnight, home charging.
- Standard outlets can also provide an option for "peace of mind" charging using onboard equipment on the go.
- Uses standard J1772 coupler.
- In-vehicle power conversion.

8 - 20 + Hours Charge Time

Level 2

Attributes

- Free-standing or hanging charging station units mediate the connection between power outlets and vehicles.
- Requires installation of charging equipment and often a dedicated 20-80 amp circuit, and may require utility upgrades.
- Well-suited for inside or outside locations, where cars park for only several hours at a time, or when homeowners seek added flexibility of use and a faster recharge.
- The public context requires additional design features, such as payment and provider network interfaces or reservation systems.
- Uses standard J1772 coupler.
- In-vehicle power conversion, charging speed limited by onboard charger.

4 - 8 Hours Charge Time

DC Fast Charge

Attributes

- Free-standing units, often higher profile.
- Enable rapid charging of EV battery to 80% capacity in as little as 30 minutes.
- Electrical conversion occurs in EVSE unit itself.
- Relatively high cost compared to level 2 chargers, but new units on the market are more competitively priced.
- Draws large amounts of electrical current, requires utility upgrades and dedicated circuits.
- Beneficial in heavy-use transit corridors or public fueling stations.
- Standard J1772 "combo" coupler approved in October 2012.

8 - 20 + Hours Charge Time

Source: WXY Architecture + Urban Design,."EV-Ready Codes for the Built Environment: Electric Vehicle Supply Equipment Support Study." November 2012

- Automated connection using an overhead conductive coupler.
- Installed on route or at transit centers where layovers occur, allowing for opportunity charging; may also be installed at the bus depot or yard.
- Serves multiple BEBs operating on routes or from transit centers.
- Used for buses with smaller battery packs and less range.

- Wireless or inductive charging:
  - Installed on route or at transit centers where layovers occur but could also be used at bus depots.
  - Serves multiple BEBs operating on routes or from transit centers.
  - Used with buses with medium-to-large battery packs and medium range.

There are some barriers to deploying e-trucks and buses on a larger scale for fleets. Although the availability of commercial product offerings is currently a major issue preventing further adoption, the cost to provide electricity for charging has been underestimated by many deployed electric vehicle fleets. Other considerations that can make cost estimation difficult are:

- Vehicles generally need to be charged where they are parked (near a conveyor belt or on a yard) which may not be close to the existing utility service drop;
- Additional power at vehicle parking locations may require excavation, conduits, cabling and repaving;
- Every bus depot, delivery center or truck yard is different.
- The age of the electric infrastructure, the electric capacity available for expansion, and the charging infrastructure costs are hard to estimate;
- The duration to complete an infrastructure upgrade can vary from several days to up to one year and depends on many parameters, at which time vehicles cannot be operated; and
- Charging systems are not standardized, raising concerns among fleet operators about the operability of future vehicle models using existing infrastructure.

Electric vehicle charging infrastructure costs can be high and vary widely depending on existing conditions. In addition, the faster a vehicle needs to be charged, the more expensive the charging infrastructure will be. These costs do not include upgrades in the distribution system that may be needed if the rated capacity of the installed electric equipment is exceeded.

For example, a fleet with 20 e-trucks at a facility in Southern California had to upgrade a transformer on the customer side to accommodate the added load to the facility. In this particular case, the $470,000 transformer price tag had a significant impact on the total project cost.

Working with utility providers, along with other private and public partners, can help mitigate concerns or difficulties for implementing electric vehicle charging in fleets. Continued development and support for charging stations is needed to allow for truck and bus fleets to be converted to alternative fuels.

Rockford Mass Transit District's 35’ Diesel Hybrid Electric Bus.

Existing Conditions & Policies

As the market shifts towards widespread acceptance of electric vehicles (EV) and alternative fuel technologies, federal, state, and local governments are working to stay ahead of the curve through planning, programming, and implementation of emerging technologies and supporting new infrastructure needed during this transition. Continued progress towards full-scale implementation of electric vehicle supply equipment (EVSE) infrastructure and technology is approaching rapidly from the private sector. Therefore, the public sector needs to be prepared for emerging technologies to ensure that public infrastructure adequately addresses these innovations. Taking a proactive approach ensures that investments are made collaboratively; as well as ensures that investments made are in alignment with one another. This enables the consumer market to shift towards EV integration and ensures that the necessary public and private infrastructure will exist for consumer use.

As highlighted above, one of the largest barriers to widespread EV adoption and acceptance is the perception that existing infrastructure is insufficient or does not exist for practical use. While there is some truth in these perceptions, it is not true for all markets nationally. For example, many states and regions have plans for future planning, programming, and investment into EVs, such as the REV West: Electric Vehicle Policy Baseline for the Intermountain States and the Northeast Corridor Regional Strategy for Electric Vehicle Charging Infrastructure. Additionally, with more than 25,000 stations and more than 79,000 outlets nationally, nearly every major metropolitan area has access to at least one kind of electric vehicle charging station.[i]

However, the gap between rural and urban America remains. According to the Center for Rural Affairs (CRA) the viability of EVs for rural America is limited. A lack of access, barriers to cost, and misconceptions surrounding electric vehicles make them a difficult sell to rural America. This is attributed to expensive up-front cost, lack of private investment, and difficulty in determining what funding is available or applicable.[ii] Therefore, broader accessibility to EVSE grid infrastructure and technology is a goal for many federal, state, and local agencies, through their development of plans, initiatives, and grant funding opportunities. As highlighted by the United States Department of Energy's (DOE) Alternative Fuels Data Center (AFDC), electric vehicle infrastructure should be a priority as the market shifts. This includes the goal of creating a national network of electric vehicle infrastructure that serves users as well as existing petroleum-based fuel infrastructure, such as gas stations, diesel powered buses, etc.[iii]

As mentioned, priority development of electric vehicle infrastructure to the same level that currently exists with petroleum-based infrastructure, such as gas stations and travel stops, should be the goal of both public and private agencies. This requires additional investment into retrofitting existing infrastructure. For example, the needs of future drivers using electric vehicles will not be the same as current internal combustion engine vehicles (ICEVs). Current infrastructure is developed with the intention of minimal time spent at gas stations, convenience stores, refueling stores, and travel stops. The current average amount of time spent at these locations are around 10.5 minutes.[iv] In the future, infrastructure will need to be constructed with longer down times considered; for example the average time spent at a location with a DC fast charging station is 20 to 30 minutes. Also, the adjacent infrastructure will need to be complimentary. For example, walkable retail developments would be recommended surrounding charging stations because of the extended amount of time spent). Finally, there will likely not be a need for the same amount of gas stations with electric charging

EV Charging Station at Nicholas Conservatory & Gardens. Rockford, IL.

The Association for Convenience and Fuel Retailing (NACS) found that consumers spend, on average, approximately 3 to 4 minutes at convenience stores (more than 80 percent of these stores sell fuel; while a large portion of stores sell fuel in addition to other services, approximately half of consumers just stopped for fuel during their visit). The NACS also found that consumers spend, on average, approximately 4 minutes/visit pumping gas or about 208 minutes/year or 3.3 hours/year.[v]

infrastructure at a 1:1 ratio (i.e. every gas station is not going to become an electric charging station) due to the abundance of charging location options.

The following sections provide detailed information related to existing conditions; it provides examples of planning and programming with respect to the United States Federal Government, the State of Illinois, the Region 1 Planning Council (RPC), and the municipalities in its service area, as well as examples from the City of Chicago and the Chicago metropolitan area. The information included below is not a comprehensive list of federal, state, and local resources; however, it does include those that were utilized in the development of this plan. Further, the information included below, while comprehensive and descriptive in nature, is not exhaustive of all information available and should not be taken as such. The information included below is reflective of the most current data available, 2017 and 2018, unless otherwise noted. The data and information included below is cited where applicable.

Federal Policies and Programs

The United States Federal Government is embracing the shift to EVs through the various agencies and departments under its control. Federal agencies often influence state and local policy through executive actions, policies, and legislative recommendations as well as through funding options, such as grant opportunities, and loan programs. Federal departments often assist or coordinate the execution, implementation, and enforcement of the policies, legislative actions, and funding programs developed through federal agencies and Congress. These actions are reflected through the planning, programming, and funding of infrastructure and technology projects that support federal initiatives. The Department of Energy's (DOE) division of Energy Efficiency & Renewable Energy (EERE) and the United States Department of Transportation's (DOT) Federal Highway Administration (FHWA), have provided plans, data, goals, or recommendations in some capacity.

Federal Legislation

Numerous federal legislation measures have been passed by Congress in relation to alternative fuels, electric vehicles, and environmental protections.[vi] Highlighted information related to key federal legislative actions since 1970 is summarized below:

- **Clean Air Act (1970):** The Clean Air Act (CAA) defined environmental standards for protecting and improving air quality. These included the development of comprehensive federal and state regulations that limited emissions, as well as mandating states to develop implementation plans to reach and enforce these standards. The CAA represents the foundation for environmental and air quality standards which exist today. The CAA continues to influence policy, legislation, and regulations that deal with environmental protection.
- **Energy Policy and Conservation Act (1975):** The Energy Policy and Conservation Act (EPCA) established Corporate Average Fuel Economy (CAFE) standards for on-road vehicles. This has aided improvements to national fuel economy standards for new motor vehicles.
- **Alternative Motor Fuels Act (1988):** The Alternative Motor Fuels Act (AMFA) created incentives to vehicle manufacturers in the form of CAFE credits for the production of motor vehicles capable of operating on certain alternative fuels.
- **Surface Transportation Acts (1991 – 2015):** The surface transportation acts passed by congress during the 1991, 1998, 2005, 2012, and 2015 sessions authorize funding for highway construction and highway safety and public transportation programs. These acts also established the Congestion Mitigation and Air Quality Improvement Program (CMAQ) and the Clean Fuels Grant Program. CMAQ has three performance measures that must be tracked, annual hours of peak hour excessive delay per capita (PHED), percent of non-single occupancy (SOV) vehicle travel, and total emission reduction.[vii]
- **Energy Policy Act (1992, 2005):** The Energy Policy Act (EPAct) was developed with the intention of reducing U.S. dependence on petroleum and improving air quality by addressing all aspects of energy supply and demand, including alternative fuels, renewable energy, and energy efficiency. EPAct required federal and state fleet providers to acquire more alternative fuel vehicles. EPAct also established the Clean Cities Program, under the DOE. The 2005 EPAct amendment addressed new grant programs, tax incentives, and initiatives that support the development of alternative fuel vehicles and their use. It also amended existing regulations and updated fuel economy testing procedures established in 1992.
- **Energy Independence and Security Act (2007):** The Energy Independence and Security Act (EISA) aimed to reduce U.S. dependence on foreign oil. It established a mandatory Renewable Fuel Standard, which required transportation fuel sold in the U.S. to contain a minimum of 36 billion gallons of renewable fuels annually by 2022. It also raised the CAFE standard to 35 miles per gallon by 2020. EISA also included funding for the development of cellulosic biofuels, plug-in hybrid electric vehicles, and other emerging electric vehicle technologies.

Since EISA more legislative action has been passed by Congress. This has enabled funding, programming, policies, and regulatory language that supports the development of EVs, EV infrastructure, and alternative fuel technology and infrastructure. There is broad federal support for the development and use of EVs as a practical alternative to existing ICEVs as seen by the previously listed legislation and plans.

Department of Energy

The DOE, operating through its office of Energy Efficiency & Renewable Energy (EERE), promotes the development, integration, and adoption of sustainable transportation technologies as well as supporting the integration of clean energy into a reliable, resilient, and efficient electricity grid.[viii] Through programs, such as the Cities Leading Through Energy Analysis and Planning (C-LEAP), the EERE provides a comprehensive profile of data and information that supports the development, integration, and adoption of city-sponsored data-driven energy policies, programs, and projects that have the potential to drive a sea of change in the national energy landscape.[ix] The EERE's Alternative Fuels Data Center (AFDC) provides information, data, and tools to help fleets and other transportation decision makers find ways to reach their energy and economic goals through the use of alternative and renewable fuels, advanced vehicles, and other fuel-saving measures. The AFDC provides a portal to a number of data sources, research reports, and information relating to alternative fuel, EVs, renewable fuels, and emerging transportation technologies.

Department of Transportation

The Federal Highway Administration (FHWA), a division of DOT, is supportive of the integration of electric vehicles into the existing U.S. transportation network. FHWA's main support of a broad electric vehicle integration is applied through their Alternative Fuel Corridors (AFC) program. The DOT, in partnership with DOE, developed a classification for the national interstate system that identifies corridors in the national system, and state recommendations, that possess consistent access to alternative fuel and electric alternative options, such as hydrogen, propane, natural gas.[x] These corridors are designated as Alternative Fuel Corridors. DOT assigns the corridors based on recommendations from state and local officials, with updates every five years.

The national network of AFCs is robust around the nation's larger urban areas; however, it lacks severely in rural areas. Further, the current national system of charging and alternative fuel infrastructure is generally underdeveloped relative to what is necessary to reach the goals and policies developed through various levels of government. According to the International Council on Clean Transportation (ICCT), approximately 10,000 additional DC fast-charging stations are needed along busy highways and interstates to support trips between metropolitan areas, like the I-90 corridor between Chicago and Rockford.[xi]

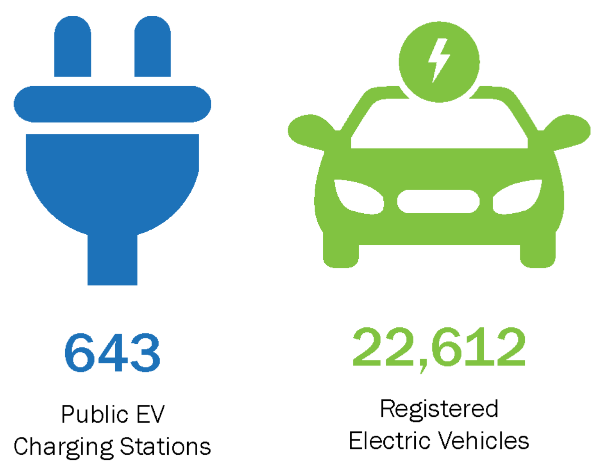
Currently, in the Chicago metropolitan area, there are electric, propane, and compressed natural gas corridors along many of the interstates, such as I-90, I-94, I-290. The DOE and DOT requires a maximum of a 50-mile gap between fast charging stations for typical interstate driving and a 30- to 35-mile gap between fast charging stations in mountainous areas.[xii] The I-90 Corridor between Rockford and Chicago is an excellent candidate for an AFC. The Illinois State Toll Highway Authority, which manages 294 centerline miles of roadway, recently invested more than $2.5 billion into widening, reconstructing, and investing into technology upgrades for the I-90 corridor.[xiii] The project included investments into flexible infrastructure and technology that allows I-90 to communicate real time traffic information, utilize intelligent signage, and flexible lanes that all work towards making I-90 a "21st century corridor."[xiv]

State Policies & Programs

Electric vehicles and hybrids are becoming more prevalent in state. As of August 2020, there were over 22,600 PEVs registered in the State of Illinois.[xv] This is nearly double the amount of electric vehicles registered in August 2018. Of the registered EV and hybrids, the highest concentrartion is within Cook County and its surrounding collar counties.

Illinois has an estimated 750 charging stations, of which only 643 are accessible by the public. Additionally, a network of public electric charging stations and DC Fast Charging stations allows for travel throughout most of the State of Illinois. By comparison, the State of California has the highest amount of public charging stations, approximately 6,621, while the State of Alaska has the lowest amount nationally at 22. Illinois is ranked 13 in the highest number of public electric charging stations.[xvi]

Figure 3-1. Statewide Electric Vehicles & Charging Stations



Source: U.S. Department of Energy, Alternative Fuels Data Center. Illinois Secretary of State, Vehicle Service Statistics. (August 2020)

State Policies

The State of Illinois has a number of varying requirements based on the entity or agency that is constructing, managing, or operating EVSE infrastructure. In Illinois, ESVE operators who "own, control, operate, or manage a facility that supplies electricity or natural gas to the public exclusively to charge battery electric and plug-in hybrid electric vehicles or fuel natural gas vehicles are not defined as a public utility."[xvii] Being defined as a public utility impacts an organization's ability to monopolize legally. It also affects funding options, regulatory controls and capacity, and taxing structure. Installation requirements for the State are authorized and regulated under a number of Illinois Combined Statutes (ILCS) including:

- **Reference 605 Illinois Compiled Statutes 5/4-223:** Highway Electric Vehicle Supply Equipment (EVSE) Installation Authorization. The Illinois Department of Transportation (IDOT) may install EVSE at each interstate highway rest area where electrical service will reasonably permit, if these installations and charging EVSE user fees are allowed by federal regulations. IDOT may adopt specifications detailing the type of EVSE and rules governing station siting, user fees, and maintenance.
- **Reference 605 Illinois Compiled Statutes 10/11(e):** Toll Highway Electric Vehicle Supply Equipment (EVSE) Installation Requirement. The Illinois State Toll Highway Authority (ISTHA) must construct and maintain at least one EVSE at any location along toll highways where it has entered into an agreement with an entity for the purposes of providing motor fuel service stations and facilities, garages, stores, or restaurants. ISTHA may charge a fee for the use of the EVSE to offset the costs of construction and maintenance. ISTHA may also adopt rules regarding station siting, user fees and maintenance.
- **Reference 220 Illinois Compiled Statutes 5/3-105, 5/16-102, and 5/16-128A:** Electric Vehicle Supply Equipment (EVSE) Installation Requirements. Vendors that install EVSE must comply with Illinois Commerce Commission (ICC) certification requirements. For specific requirements, see the ICC EVSE Installer Certification website.
- **Reference 220 Illinois Compiled Statutes 5/3-105, and 20 Illinois Compiled Statutes 627/10:** Public Utility Definition. An entity that owns, controls, operates, or manages a facility that supplies electricity to the public exclusively to charge battery electric and plug-in hybrid electric vehicles are not defined as a public utility. An entity that supplies compressed natural gas to fuel natural gas vehicles is also not defined as a public utility.[xviii]

State Incentives

The State of Illinois offers a number of incentives for the development of EV and alternative fuel infrastructure. Examples of these incentives are detailed below:

- **All-Electric Vehicle (EV) Emissions Inspection Exemption:** This incentive removes the emissions inspection requirement for electric vehicles that is required in most municipalities.
- **Smart Grid Infrastructure Development and Support:** This incentive establishes a trust that provides financial and technical support to public and private entities within the state for programs that relate to innovative technologies and methods to further modernize the state's electric grid.
- **Transportation Electrification Infrastructure Projects:** This incentive establishes a grant program, administered by the IEPA, that funds the investment into medium-and-heavy-duty vehicle charging, electrification of public transit, fleets, and school buses.

Illinois also offers exemptions for public infrastructure conversion to alternative and electric options; tax exemptions for biofuels, and incentives for the financing of PEVs.[xix] There are also a number of incentives offered through private companies and local municipalities. These incentives may include discounted charging rates for EV drivers, EV-only restricted parking in certain areas, or discounts on vehicle insurance.[xx] Through public private partnerships, policy recommendations, and statewide agency goals, the State can work to be as prepared as possible for electric vehicles. Detailed below are policy and goal alignments through respective state agencies; including the Illinois Department of Transportation (IDOT) and the Illinois Department of Energy (IDOE).

State Energy Considerations

The State of Illinois enjoys a dynamic and extensive power generation network; the power generated in Illinois comes from a variety of different sources, such as nuclear, coal, and natural gas. According to the Illinois Energy Association (IEA), the largest energy producers in Illinois are Ameren Illinois and Commonwealth Edison Illinois.[xxi] Unfortunately, in August 2020, Exelon announced the closure of two of its nuclear plants in Northern Illinois, the Byron Nuclear Plant in Ogle County and its Dresden Plant in Morris, Illinois. The closure of the Byron Nuclear Plant will result in finding alternative energy sources for electricity for the region, which may not be as clean as nuclear power.

Due to the State's central location, in combination with a well-developed infrastructure network, it acts as a central hub for the exchange, sale, and transfer of energy between states and private entities. According to the U.S. Energy Information Administration (EIA), Illinois sold approximately one-fifth of its annual energy production to neighboring states, including Indiana, Missouri, and Wisconsin, through energy exchanges, sales, and transfers in 2017. Illinois is the 5th largest consumer of energy in the U.S. with more than half of the power generated being provided by nuclear energy.[xxii]

Renewable energy production accounts for roughly seven percent of energy production in Illinois. Nearly all of the renewable energy generated in the State is produced through wind power. However, Illinois' largest renewable resource is biofuels. The State of Illinois possesses some of the most fertile cropland in the continental U.S. Nearly 89 percent of the cropland in Illinois is considered "Prime Farmland," totaling about 19.5 million acres. Illinois is also a leading producer of both ethanol and biodiesel. Due to large corn and soybean production, Illinois is the third-largest producer of ethanol in the U.S. as well as having the third-largest ethanol production capacity and fourth-largest biodiesel production capacity in the nation. Even still, wind remains the primary source of renewable energy. In moving towards a cleaner, more sustainable future, the State will have to continue to encourage the development of alternative energy production sources, the development of wind power, and the use of alternative power sources to reduce reliance on fossil fuels.

Illinois Department of Transportation

The Illinois Department of Transportation (IDOT) supports the State's initiatives and goals related to EVs, EV infrastructure, and alternative fuel investments. IDOT's Long-Range Transportation Plan (LRTP) establishes the agency's strategic goals for the planning, programming, and development of the State's infrastructure system. The LRTP envisions a transportation system network that is "innovative, sustainable, and multimodal; and supports local goals and Illinois' economy." The LRTP identifies five performance goals which provide the overarching themes of the LRTP and represent IDOT's vision converted into measurable, trackable action items. The LRTP's five goals are Economy, Livability, Mobility, Resiliency, and Stewardship. The Livability and Mobility goals align with the goals of this readiness plan and are, briefly detailed below.

IDOT defines livability as "...improving the quality of life while supporting broader sustainability goals. Livability consists of multidimensional issues relative to land use, environmental protection, enhanced mobility and accessibility, public health, and economic well-being."[xxiii] For the purposes of the Electric Vehicle Readiness Plan, livability is intended to be viewed as how the integration and investment of EVs into the broader transportation system will impact the environment, access, mobility, and the economy, along with how these systems interact with EV technology and infrastructure in a beneficial manner - especially to populations that are traditionally underserved.

IDOT's LRTP directly highlights two objectives for the inclusion of underserved populations into the integration of alternative vehicle/EV technology and infrastructure. These are included below.

- **Livability Objective 4:** *Enhance existing policies and practices related to under-served populations so outreach and inclusion are effective and go beyond meeting the minimum federal requirements.* IDOT is committed to the investment and improvement of affordable alternative modes of transport for under-served populations. While IDOT does not directly control local and regional access to many forms of transport, the funding they provide plays an integral part in influencing access and subsequent mobility. IDOT is working internally and with partner agencies to ensure funding, policies, and performance standards meet or surpass federal requirements relating to equality, equity, and access.[xxiv]
- **Livability Objective 5:** *Utilize a sustainable approach to transportation planning, design, construction and operation which promotes environmental stewardship and energy conservation.* IDOT is committed to the incorporation and support of sustainable technology in operations of current and future IDOT assets, including multimodal transportation services. For example, the inclusion of EV technology and infrastructure into future IDOT assets; as well as, the inclusion of these into retrofitting of existing assets.[xxv]

Local Initiatives

Within the three county study area of Boone, Ogle, and Winnebago Counties, the number of electric vehicles is rapidly increasing. As of August 2020, according to the State of Illinois vehicle registry, there are 291 fully electric vehicles and 5,191 hybrid electric vehicles registered in the study area. The number registered electric vehicles and hybrids by county are shown in Table 3-1. The number of electric vehicles registered within the three counties has more than doubled (144.5 percent) between August 2018 and August 2020. The county with the highest increase in the number of registered electric vehicles was Boone County, which increased from 11 registered in August 2018 to 48 by August 2020, an increase of 336.4 percent.[xxvi] The rapid increase of the number of electric vehicles registered within the study area demonstrates the importance of planning EV charging infrastructure.

Currently, there are 31 publicly accessible alternative fuel stations located within the study area. Of the publicly accessible alternative fuel states, nine are electric charging stations with 35 charging outlets, shown in Figure 3-2. There are seven Level 2 charging stations and two DC Fast Chargers. These fuel stations are publicly accessible but privately owned and includes stations for Tesla vehicles only.

Rockford Metropolitan Area

Within the Rockford Region, the Region 1 Planning Council (RPC) is the Metropolitan Planning Organization (MPO), in charge of coordinating long term regional transportation planning. In 2020, the RPC updated the 2050 Metropolitan Transportation Plan (MTP), which addresses the transportation system in the Rockford Metropolitan Planning Area (MPA), consisting of the urbanized portions for Boone, Ogle, and Winnebago Counties. It provides an innovative and sustainable framework for the region's

Table 3-1. Electric Vehicle Registration by County

County	Electric Vehicles	Hybrid Electric Vehicles
Boone	48	705
Ogle	28	623
Winnebago	215	3863
Total	291	5191

Source: Illinois Secretary of State, Vehicle Service Statistics. (August 2020)

Figure 3-2. Regional Electric Vehicle Charging Stations, 2020

Source: U.S. Department of Energy. Alternative Fuels Data Center.

transportation network over the next twenty to thirty years. The plan seeks not only to satisfy existing federal requirements for MPOs, but to look at forthcoming trends and issues to better prepare the regional landscape for challenges and needs of the future. As part of the 2020 update, goals and objectives that were identified to establish a strategic direction for the plan and strategies were put in place to attain results.

Detailed below are goals, objectives, and strategies from the 2050 MTP that relate specifically to the EV Readiness Plan and electric vehicle infrastructure in general:

MTP Goal 2: Emphasize a transportation system that is maintained and operated efficiently.

- **Objective 2.1:** Maximize the multimodal capacity and operating performance of existing and future transportation infrastructure and services.
  - Identify the need for transit signal prioritization and other modal related technologies/strategies for improving multimodal corridors.

MTP Goal 4: Enhance quality of life through integrated transportation and land use planning.

- **Objective 4.1:** Minimize and mitigate air and water quality impacts from existing and future transportation facilities, services, investments, and operations.
  - Develop a regional Electric Vehicle Readiness Plan and Implementation Plan.
  - Establish recommended standards for public and private incorporation of renewable energy (e.g. electric vehicle charging stations, etc.).
- **Objective 4.2:** Enhance and promote equity and

accessibility in the transportation system contributing to an overall improvement in quality of life.
- Develop regional complete streets policy.

Goal 5: Ensure transportation investments effectively serve the regional transportation needs.

- **Objective 5.1:** Enhance coordination and collaboration in planning, programming, and implementation activities with state, regional, and local partners.
  - Coordinate with local and statewide partners in the development of connected autonomous vehicle (CAV) initiatives.

The MTP also identifies the need for further regional cooperation in planning efforts to allow for efficient use of resources. The second phase of the EV Readiness Plan will provide resources and guidance to the community.

Greenest Region Compact

In 2019, Mayor Tom McNamara of Rockford signed Metropolitan Mayors Caucus' Greenest Region Compact. This compact has been adopted by 131 communities in Northern Illinois, highlighting the larger region's committment to improving quality of life for their residents by building vibrant, sustainable communities in the greater Chicago area. The consensus goals of the Greenest Region Compact aim for enhanced quality of life for residents; protection and stewardship of the environment and sustainable economic vitality. The foundation of the Greenest Region Compact is 49 high-level goals. Some of the goals that directly relate to electric vehicles and EV charging stations, include:

- Reduce greenhouse gas emissions;
- Maintain clean and healthier area;
- Enact policies that support clean energy;
- Engage the community in clean energy practices;
- Integrate sustainability into transportation choices;
- Promote public and sustainable transportation choices; and
- Ensure local policies and codes support sustainability;

Chicago Metropolitan Area

The Chicago Area Clean Cities Coalition (CACC) is a collaborative effort of the Chicagoland area to reduce or completely eliminate the use of internal combustion electric vehicles (ICEVs) in the state’s most populous area. For over two decades, the CACC has been an effective tool for minimizing or eliminating the use of petroleum throughout Cook, DuPage, Kane, Lake, McHenry, and Will Counties. The CACC works to enhance and promote the use and implementation of alternative fuel and hybrid vehicle use and infrastructure.

The City of Chicago is also cognizant of the necessity to improve and protect air quality, promote regional sustainability, and support the protection and enhancement of the overall environment. The 2012-2015 Sustainable Chicago plan identifies seven key sustainability categories that are critical to the City’s mission to reduce carbon emissions, promoting sustainability, and enhancing livability.[xxvii] The 2012-2015 Sustainable Chicago plan highlights transportation goals as a critical component for “…diversifying transportation options, reducing traffic congestion, improving air quality, and enhancing quality of life…”, including two goals detailed below:

- **Chicago's Transportation Options, Goal 11:** Strengthen the Infrastructure to Advance Vehicle Efficiency. This goal aims to improve and advance vehicle efficiency by achieving a taxi fleet of more than 75 percent hybrid or compressed natural gas (CNG) vehicles; investing in a dense network of electric vehicle charging stations; and promoting the use of clean fuels, clean vehicle technologies, and the development of an alternative fuel infrastructure. This investment and promotion of alternative and clean vehicle technology will support the reduction of the use of gas powered vehicles in the City of Chicago.
- **Chicago's Transportation Options, Goal 12:** Reduce Municipal Fossil Fuel Consumption by 10 percent. In alignment with Goal 11, the City of Chicago is acting on their mission to reduce fossil fuel consumption by investing in more efficient vehicles. The City aims to reduce the number of city owned vehicles; improve the efficiency of garbage services through grid-based routing; and replace at least 3 percent of fleet vehicles with alternative fuel and “green fleet” vehicle alternatives. This goal directly supports the City’s overarching goal of improving the existing transportation system and making it more sustainable year over year.

Benefits & Challenges

Benefits

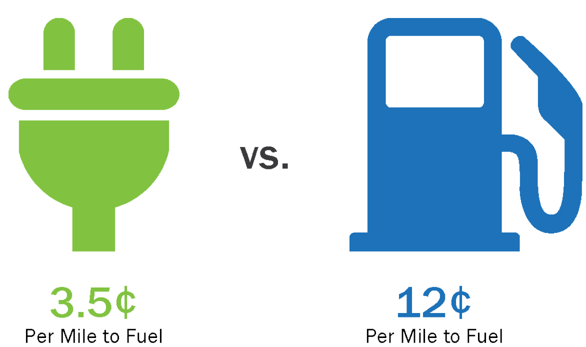
A number of benefits have been associated with the implementation of a Regional EVSE Coordinated Policy, such as economic, environmental, and quality of life benefits. Driving electric vehicles (EV) can help reduce U.S. dependence on oil, which has associated benefits for the country's economic and national security. EVs can also help businesses with fleets save money and insulate them from high and volatile fuel prices, while providing other performance benefits. An acceptance of EVs and implementation of electric vehicle charging infrastructure by the business community can be assisted through a convenient permitting process and clear codes. PHEVs and BEVs are both capable of using off-board sources of electricity, and U.S. electricity is produced domestically from fuel sources that are low and stable in price. Illinois, in particular, produces a majority of its energy from nuclear power, reducing the environmental impacts of the process. All of the benefits listed below can contribute to a more resilient region, one that is better able to withstand shocks from fuel prices and oil production.

Quality of Life

EV technology and related infrastructure directly supports the improvement of quality of life while being cognizant of sustainability, the environment, mobility, public health, and the economy. EVs are more sustainable long-term, as well as better for the environment and public health when compared to traditional, petroleum-based vehicles because of decreased or nonexistent emissions. Further, as EVs proliferate the consumer market - in combination with the emergence of "ridehailing" and "ridesharing" apps - the necessity of the traditional, by changing how individuals will travel on a day-to-day basis.

EVs will also contribute to an improvement of mobility and accessibility for traditionally underserved populations and those who have historically lacked access to public transportation, private vehicles, or other modes. Through electric vehicle technology there will be improved access to varying modes of transportation (e.g. public transit, e-hailing, ridesharing, private vehicles). However, this improvement in mobility and access will not be equally distributed nationally. The improvements will predominantly benefit those individuals living in denser, urban areas, which excludes a large portion of the population (e.g. rural America, external suburbs, inner suburbs) who lack access and mobility to varying modes of transportation.

Figure 4-1. Comparision of Electric to Gasoline Cost Per Mile



Source: U.S. Department of Energy. Alternative Fuels Data Center.

Economic

There are several economic benefits from implementing EVSE in the region. Electric vehicles can support electricity generation from renewable sources and optimize electricity use in a region or state, resulting in saving both in terms of resources and costs. When combined with renewable energy sources, smart electric vehicle charging stations can monitor the strain on the electric grid and adjust its energy consumption to align with peak times for solar or wind generation .In addition, the intelligent controls can help balance utility load levels throughout the day by charging EVs when demand for electricity is lower. For example, on a hot day when electricity use for air conditioning is high, a smart charging station can draw less power for charging when demand is high, but ensure the EV is charged within an acceptable time frame. ComEd offers several rate options for Illinois users that encourage EV drivers to charge overnight and during times of lower electricity demand to even out grid load.

These types of electricity demand controls and incentives will become increasingly important as more renewable sources come onto the grid. By encouraging utility customers to even out the grid load and using renewables, electric vehicles can help slow growth in electricity costs, even for customers who do not drive EVs.

Another economic benefit is the potential stability of electric prices, combined with the high efficiency of electric motors, resulting in fuel costs that are typically 75 percent less than retail gasoline and diesel. A typical electric vehicle charged at an average electricity price of 11 cents per kilowatt hour (kWh) costs approximately 3.5 cents per mile to the fuel. In comparison, the average internal combustion engine vehicle (ICEV) costs 12 cents per mile to fuel at a five-year average gasoline price of $3.39 per gallon. In the same way that gasoline costs vary by region, the price of electricity and generation sources also varys by region. The precise economic and environmental benefits from deploying EV is dependent on the specific location in which they are deployed.

Efficiency

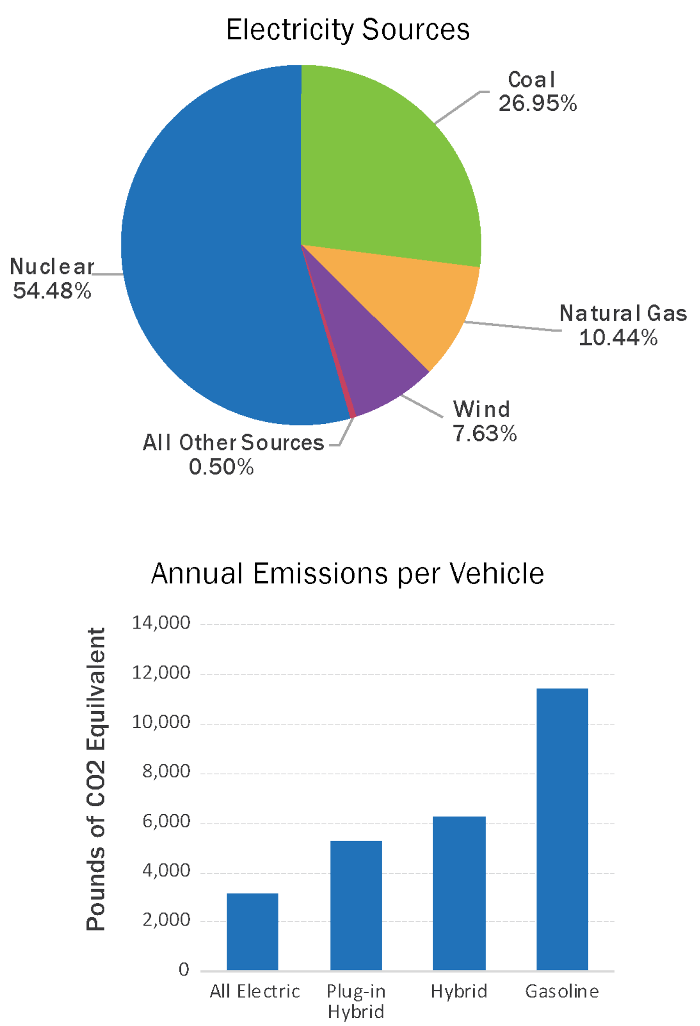
Because electric vehicles rely in whole or in part on electric power, their fuel economy is measured differently than conventional vehicles. Electric vehicle performance is often measured in miles per kilowatt-hours (kWh) or kWh/100 miles. To make a comparison with conventional vehicles, it is common to see these metrics converted to miles per gasoline gallon equivalent (MPGe) metric. Depending on how they are driven, today's most common light-duty EVs can exceed 100 MPGe, while some can drive up to 300 miles on a single charge. In comparison, the average internal combustion engine (ICE) vehicle has a range of 300 to 500 miles on a tank of gas. While they may not be equals currently, EVs are becoming increasingly competitive in fuel economy compared to ICE vehicles. The efficiency of electric vehicles, particularly BEVS, which do not have an ICE, can be seen in the lack of maintenance required. Fewer moving pieces in the engine can lead to a considerably cheaper yearly maintenance fee. Because of lower maintenance and fuel costs, EVs have lower lifetime cost than conventional vehicles.[i]

Sustainability

Electric vehicles also have significant emissions benefits over conventional vehicles. When operating on battery power, plug-in electric vehicles do not emit greenhouse gases (GHGs) or traditional tailpipe pollutants, such as oxides of nitrogen and sulfur. EVs can have some impact on emissions in the power sector, where electricity is generated to fuel them. The life cycle emissions of a BEV or PHEV depend on the sources of electricity used to charge it, which varies regionally. In regions that use relatively low-polluting energy sources for electricity production, EVs may demonstrate a higher life cycle emissions benefits. Even when electricity is produced from coal, the higher efficiency of EVs often results in a net reduction of GHG emissions.

With electricity produced by a mix of sources, Department of Energy calculations show that EVs still result in less than half the CO_2 emissions associated with an average gasoline vehicle in almost all metropolitan regions.[ii] Greenhouse Gas (GHG) emissions from EVs will decrease further with the trend toward lower carbon intensity in the US electricity sector.[iii] Figure 4-2 shows a comparison of well-to-wheels CO_2 emissions for different vehicle technologies based on average national electricity generation mix. Detailed assumptions for this analysis are available at the Alternative Fuels Data Center.

Figure 4-2. Well-to-Wheel CO_2 Emissions



Source: U.S. Department of Energy. Alternative Fuels Data Center.

Challenges

Electric vehicles offer a number of advantages to consumers, including low total cost of ownership from considerable lower maintenance (hundreds of fewer parts) and fuel costs, quiet operation, home charging, support for cleaner air and reduced GHG emissions, and reduced dependence on imported energy. However, addressing challenges is necessary before widespread market penetration can be expected.

Incomplete Charging Network

The national network of fast charging along intercity and interstate corridors is incomplete, lacks home-charging options for many multi-family building residents, and charging infrastructure at destinations and workplaces remains inconsistent. Even in corridors and cities with extensive charging, there is a general lack of knowledge about how and where to charge. Along with an incomplete knowledge of charging options, inconsistent charging infrastructure between jurisdictions can lead to difficulties for users. There must be coordinated efforts amongst leaders to ensure the transportation system is usable.

Lack of Incentives

Some states such as California, have policies and incentives to promote electric vehicle purchase by users. There are also incentives for the installation of EVSE, such as those given by the Volkswagen settlement. Without these types of incentives broadening the use of EVs and EVSE will be difficult in Illinois. High costs for the initial investment continue to be a barrier for users that would benefit most from the use of EV.

Reliance on Motor Fuel Tax

The Motor Fuel Tax (MFT) is imposed on the privilege of operating motor vehicles on public highways and recreational watercraft on waterways in Illinois. It is paid by distributors and suppliers who collect the tax from customers. The MFT is one of the sources of funding used in the state specifically for transportation projects, however with a decrease in gasoline consumption there would need to be a discussion on alternative funding sources. To offset electric vehicle users not paying into the MFT, Illinois has set an additional $100 per year fee.

Moving EVSE Forward

Preparing for an economic and logistical future influenced by electric vehicles (EV) is attainable for communities of all sizes. Not every community will have the same needs or challenges but overarching goals will help guide the region towards EV readiness. There are individual communities in Illinois that have begun work on preparing for electric vehicle infrastructure, such as Chicago and its suburbs, but currently there are no statewide policies or plans in place. In the Rockford Region, there is a lack of EV focused municipal codes and ordinances, leaving parties interested in building EV infrastructure to rely solely on adjacent municipal codes, such as general electrical codes, zoning requirements, and new construction ordinances, all of which impact EV infrastructure, but which do not address EVs specifically.

While Illinois has yet to implement a statewide EV Readiness Plan, it has begun creating a sustainable, stable, and equitable system for EV readiness through regulatory measures for electricity. There are also potential electric vehicle codes and regulations that are being considered that will require electric vehicle infrastructure throughout the state where appropriate. The specific codes being proposed are detailed in the Parking section. It will be critically important moving forward to connect with a variety of stakeholders when developing the pathway to EV Readiness and EVSE deployment.

Engaging with local utility providers will be advantageous; so that utilities are service- and price-regulated. Electricity providers in Illinois are accountable to state regulators, typically have access to low-cost capital, customer histories and other legacy advantages. These advantages make consulting utility companies especially beneficial where electric vehicle supply equipment (EVSE) is yet to be robustly developed. It will also be important to work with developers and existing industries to develop codes and ordinances that encourage innovation and incentivize implementation of EVSE.

One major challenge is the continual improvement of electric vehicle infrastructure and increasing vehicle demand is moving faster than a complex, suitable policy and infrastructure development plan. To meet the demand EV development, a combination of a well-designed and efficiency-promoting policy, affordability, consumer attraction, EVSE reliability, and suitable economic conditions is required.

Detailed below are recommendations based on the review of existing EVSE infrastructure approaches and efforts that will guide EVSE deployment forward in the region. A variety of codes, ordinances, and policy examples have been presented below to provide an understanding of what options would work best for their respective areas. Moving forward, there will need to be overarching goals and targets, but how these will be reached is contingent on the specific needs of municipalities and stakeholders. Municipalities can decide how they want to approach any changes to EVSE-related municipal code, there may be higher targets internally they may want to adopt than the regional targets.

Memorandum of Understanding (MOU)

A memorandum of understanding (MOU) is critical to ensuring that a consensus among multiple parties has been made on how to develop and implement effective EVSE infrastructure. For example, a regional or multi-jurisidictional MOU can detail how a new infrastructure or technology will impact their respective jurisidictions; provide a framework for the effective development of EVSE infrastructure along major corridors and interstates that intersect with their jurisdictions; establish guidelines for local, regional, and state partners to consider or adopt in the process of establishing EVSE infrastructure; or provide a framework for a universal procurement process of EVSE infrastructure.

While not legally binding, MOUs are expressions by legal parties of their agreement on the intent to move forward with its implementation metrics. MOUs outline practical expectations for local, regional, and state parties to meet in an effort to ensure regional collaboration. MOUs generally contain information relating to the agreeing parties, the project to which they are agreeing on, the scope of that project, and the roles and responsibilities of each party in agreement. Further, the contents of a MOU detail the thoughts, expectations, and framework of a multi-party decision.[i]

Land Use

Land use is the composition of the built environment developed upon the land. Therefore, land use represents a critical component for consideration of the development of EVSE infrastructure. The administration of a cohesive and comprehensive approach to the development of EVSE infrastructure in cooperation with existing land uses will ensure that the infrastructure is integrated in a manner that is compatible both initially and in the long term.

In most cases, the EVSE infrastructure will be integrated in a retroactive manner. While there will be examples of EVSE infrastructure implemented where development does not currently exist, the majority of EVSE infrastructure will be through projects where development is already established. For example, EVSE infrastructure will be integrated into parking structures such as garages, surface lots, and street parking. This integration can come in two forms:

- The development of new parking infrastructure with EVSE infrastructure integrated; or
- The retroactive integration of EVSE infrastructure into parking infrastructure in the form of converted spaces or new EV only areas.

Effective ordinances, development regulations, zoning, permitting regulations, and codes all work collaboratively to ensure the compatible inclusion of EVSE infrastructure into existing land uses. These should all support the cohesive implementation of EVSE infrastructure into the built environment. To effectively introduce and integrate EVSE infrastructure into the broader physical structure of the built environment, most literature stresses the importance of supporting EVSE infrastructure by allowing it as an option rather than opting to mandate it. Opting to allow rather than require EVSE infrastructure as a mandatory piece of infrastructure works to remove many of the challenges a municipality or government might face with developers. Detailed below are examples of zoning, ordinances, permitting language, and codes common across the U.S.

Zoning, Ordinances, and Codes

Zoning

Defining EVSE as an allowable use in a municipality's zoning districts is a first step for EV readiness.[ii] Cities and towns are beginning to use zoning ordinances to ensure that EVSE is defined as an allowable use in residential and commercial zoning districts. The use of zoning to establish EV readiness has limitations because it has not been widely tested as a practice. For example, zoning could also be used when development standards are needed to shape the scope and quality of future EVSE deployment by requiring those characteristics in future development. While there may be pushback from developers if regulations prove cost prohibitive, effective ordinances can ensure EV is allowed in zoning districts and provide guidance for what is appropriate for specific areas.

Table 6-1 provides examples of how municipalities have addressed EV in land use and zoning ordinances, along with a recommendation for this region.

EV Charging Station, MercyHealth Medical Center, Rockford, IL.

Ordinances

By setting development standards through zoning ordinances, municipalities can use this tool to shape the scope of EVSE deployment. Regulation of EVSE through parking ordinances can set the scope and enforcement requirements for parking with state or local laws. Parking ordinances work hand-in-hand with parking management, whether public or private, to enforce regulations on the use of parking spaces, including EV charging-only spots.

A key strategy for capturing the benefits of EVs will be the development of policies and programs that aim at implementing EVSE infrastructure to meet current and future charging needs and prepare municipalities for growing EV use. Electric vehicle readiness can be achieved through zoning that requires EVSE parking in the private realm, parking ordinances that enable EVSE in the public realm, building or electrical codes that require wiring in parking and set new standards for safety and permitting that streamlines the administrative process.

There are a handful of factors that need to be in place to successfully advance policy, legislation and ordinances relevant to EV infrastructure. EV readiness planning includes creating and implementing solutions to one or more of the following barrier-reducing actions:

- Ensuring that new construction is EVSE ready;
- Clearing administrative pathways for residential service upgrades and EVSE retrofit;
- Providing safe, consistent, and accessible EVSE installations and implementing good site planning and design;
- Ensuring that new construction can support higher electricity demand, with the potential of adding future vehicle battery charging capacity and eventually energy storage devices;
- Enabling dedicated parking spaces for EVs in both public and private realms, with clear protocols for the usage and operation of the spaces and EVSE; and
- Aligning EVSE deployment with policy and environmental mandates to achieve emissions reductions, air quality improvements, transportation technology advances, and energy independence.

Codes

Building and electrical codes can also ensure EVSE installations are safe and specify the scope of EVSE-ready construction. Local jurisdictions may need to adapt local codes to meet certain requirements, such as emissions reduction goals. This is an ideal opportunity to incorporate EVSE into new construction. Code changes will require buy-in from the development community, but precedents from other cities, such as Vancouver, Canada, indicate that costs will not increase dramatically. Municipalities that adopt or amend a code benefit from a more flexible code that provides different standards for different situations. In general, building and electrical codes present different EV ready opportunities.

In the region, existing codes do not present a significant barrier to EVSE deployment, but there is room within the codes to more clearly encourage EV-readiness. Codes can help achieve EV-

Table 6-1. Incorporating Electric Vehicle Charging Station in Permitted Land Uses

Typical Ordinance Includes:	**Language Example**	
Specification	City, State	Text
Treats different types of EVSE as different land uses and may distinguish between where different types of charging stations are allowed. • Charging station types are typically distinguished as different "levels" contingent on charging speed. • Most often, levels 1 & 2 are allowed in all zones while level 3 stations are restricted to specific zoning districts. ○ May provide a table to delineate use permitted zoning districts for each station type. • May also allow for all three levels in all zoning districts.	Chelan, WA	"Level 1 and 2 electric vehicle charging stations are a permitted use in all zoning districts… Level 3 electric vehicle charging stations are a permitted use in the Warehouse and Industrial (WI), Highway Service Commercial (C-HS),…, zoning districts"
	Des Moines IA	"Levels 1, 2, and 3 electric vehicle charging stations are allowed in all zoning designations."
May require a conditional or special use permit for charging stations in specific zones.	Auburn Hills, MI	"Installation shall be subject to permit approval administered by the Community Development Department."
	Chelan, WA	"Level 3 electric vehicle charging stations…require a conditional use permit in Downtown Mixed Use (DMU), Tourist Accommodation (T-A),…zoning districts."
May place restrictions on charging stations in the right of way.	New Orleans, LA	"No property or parcel may have more than one electric vehicle charger installed in the right-of-way adjacent to such property or parcel."
	Des Moines, IA	"Electric vehicle charging stations are not permitted within the city right-of-way"

Model Code Document Name:	
Iowa Clean Cities Coalition, Leading the Charge: City Codes and Electric Vehicles	**Recommendation:** "Define what types of EVSE are allowable by land use type."
	Reasoning: "By establishing compatible charging stations according to land use types, cities can eliminate confusion about what is and isn't allowable while also affirming the desirability of EVSE within the community…"

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

readiness and regional cohesion moving forward. For example, a coordinated effort to specify requirements for certain features in new construction and provide for new permitting or inspection protocols can help to streamline EV codes across the region. Adopting EV-friendly codes that encourage EVSE deployment can promote economic development in the region. Codes can create a high-level planning framework while retaining flexibility at the local level. For example, states can adopt code appendices containing EV-friendly provisions that can be adopted at the local level. Adopting EV-friendly codes should be part of a collaboration between partners to create a comprehensive EVSE deployment strategy.

Listed in Table 6-2 are examples of requirements and standards for installing EVSE when new construction is occuring.

Complete Streets

As part of an effort to fully address all users of transportation and their needs, communities have adopted "Complete Streets" policies. Complete Streets is a transportation policy and design approach that requires streets to be planned, designed, and maintained to enable safe, convenient, and comfortable travel for all modes of travel. At the core of the Complete Streets philosophy is the idea that pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities are able to safely move along and across a street. Each Complete Street is unique and responds to the context of the surrounding area. In 2005, the National Complete Streets Coalition was formed in order to promote low cost options for existing roadways and ensure all new roadways are designed to provide safe access for all users.

Recognizing this need, the State of Illinois adopted a "Complete Street Law" (Public Act 950665) in 2007. This law provides the framework for Illinois municipalities, counties, and metropolitan areas to establish policies and standards that incorporate Complete Street principles in their planning, programming, and implementation documents. As of 2019, over 1,500 complete street policies have been passed in the United States, including 33 state governments. Approximately 55 Illinois municipalities and other entities have adopted Complete Street policies by 2019. Like the infrastructure treatments, Complete Street policies can come in many forms with varying degrees of enforcement ability.

Part of addressing the current and future needs of transportation is the incorporation of intelligent transportation system (ITS), EV needs, and preparing for connected and autonomous vehicles where appropriate. To allow for the safe movement of electric vehicles along the roadway there is an increased need for charging infrastructure to be incorporated into planned facilities. This is the next phase of Complete Streets policy considerations.

Parking

As with zoning, parking ordinances can facilitate EVSE installation by setting requirements for the number of parking spaces provided by new construction. Parking ordinances also have an enforcement component that can be used to restrict designated EVSE charging spaces in lots, garages, or on streets. Parking regulations can be implemented by localities or states. For example, Hawaii requires at least 1 EVSE charging space per 100 spaces in every newly constructed lot or garage. Parking ordinances apply to publicly accessible EVSE, including on-street parking and municipal lots and garages, and are therefore an important part of infrastructure development and management.

Parking management is a potentially important area for public-private partnerships (P3s), and in this context it will be important for localities to work with private parking management firms to ensure regulations are amenable. In public private partnership scenarios, determining how enforcement, such as towing or ticketing, will occur will be an ongoing issue that will need to be creatively solved. Examples of parking related ordinance language are shown below, including number of stalls, location, and required features.

Statewide Parking Standards

Illinois is in the process of adopting set standards for minimum EV parking requirements for "new" and "renovated" buildings. These potential standards propose new or renovated nonresidential buildings have 30 percent of its total parking spaces electric vehicle ready.[iii] The potential standards also propose new or renovated residential buildings have:

100 percent of its total parking spaces electric vehicle ready, if there are one to 6 parking spaces;

100 percent of its total parking spaces electric vehicle capable, of which at least 20 percent shall be electric vehicle ready, if there are 6 to 23 parking spaces; or

100 percent of its total parking spaces electric vehicle capable, if there are 24 or more parking spaces.

Additionally, new or renovated residential buildings shall provide at least one parking space with electric vehicle charging supply equipment installed, and for each additional parking space with electric vehicle charging supply equipment installed, the electric vehicle ready requirement is decreased by 2 percent.

SwedishAmerican Medical Center. Rockford, IL.

Table 6-2. Incorprating Electric Vehicle Infrastructure into Building Codes

Typical Ordinance Includes: Specification	Language Example: City, State	Text
May require or recommend the installation of appropriate electrical capacity and conduits to support future EVSE.	Howard County, MD	"For new occupancies subject to this section: at least 1 parking space for each 25 residential units shall feature energized outlets; and a residential unit with a garage, carport, or driveway shall feature appropriate electric vehicle supply equipment consisting of conductors, connectors, [...] so that an energized outlet may be added in the future."
	St. Louis Park, MN	"Multiple-Family Residential Land Uses: all new, expanded and reconstructed parking areas shall provide the electrical capacity necessary to accommodate the future hardwire installation of Level 2 EVSEs for a minimum of 10% of required parking spaces."
	St. Louis Park, MN	"Non-Residential Land Uses: all new, expanded and reconstructed parking area shall provide the electrical capacity necessary to accommodate the future hardwire installation of Level 2 or DC EVSEs for a minimum of 10% of required parking spaces."
	Auburn Hills, MI	"In order to proactively plan for and accommodate the anticipated future growth in market demand for electric vehicles, it is strongly encouraged, but not required, that all new one-family and multiple-family homes with garages be constructed to provide a 220-240-volt/40 amp outlet on a dedicated circuit and in close proximity to designated vehicle parking to accommodate the potential future hardwire installation of a Level-2 electric vehicle charging station."
	Auburn Hills, MI	"it is strongly encouraged, but not required, that all new and expanded non-residential development parking areas provide the electrical capacity necessary to accommodate the future hardwire installation of Level-2 electric vehicle charging stations. It is recommended that a typical parking lot (e.g., 1,000 or less parking spaces) have a minimum ratio of 2% of the total parking spaces be prepared for such stations."
May delineate zoning districts where EVSE is allowed.	Mountlake Terrace, WA	"Electric vehicle infrastructure shall be permitted in zoning districts of the city as identified in…"

Model Code Document Name:	
Model City Ordinance Relating to Electric Vehicle (EV) Charging Infrastructure	**Recommendation:** "Require that [the] main electrical switchgear be installed with sufficient space and capacity to support 20% of EV spaces at 208/240V and 40A per space, with a dedicated branch circuit and overcurrent protection device, per space."
	Recommendation: "Require that all parking spaces in a parking structure be made "EV-Capable" i.e. conduit be installed throughout the structure and subpanels sized to accommodate 60A or 40A breakers for each."

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

Table 6-3. Electric Vehicle Parking Space Design & Location

Typical Ordinance Includes: Specification	**Language Example** City, State	Text
May specify parking space size.	Atlanta, GA	"The installation of an EVSE should not reduce the electric vehicle charging station's length to below the size and standards required under section 16-28.014"
	Methuen, MA	"Where provided, spaces should be standard size parking stalls but designed in a way that will discourage non-electric car vehicles from using them."
	Montgomery County, MD	"The minimum width for a parking space for charging electric vehicles is 9 feet."
May specify the location of parking spaces on a street or within a parking lot.	Atlanta, GA	"Criteria for electric vehicle parking and charging on private streets… For the purpose of reducing cable management issues and placing the...charging station closer to crosswalks and curb ramps, such charging stations shall be installed to use the last space on a block face in the direction of travel."
	Methuen, MA	"Parking spaces for electric vehicles must not be located in the most convenient spots because this will encourage use by non-electric vehicles."
	Salt Lake City, UT	"The electric vehicle parking space shall be located in the same lot as the principal use."
	St. Louis Park, MN	"The EVSEs shall be located in desirable and convenient parking locations that will serve as an incentive for the use of electric vehicles."
	St. Louis Park, MN	"General Requirements for Single-Family Residential Zoning Districts...EVSE shall be located in a garage, or on the exterior wall of the hall or garage adjacent to a parking space."
May provide specifications about parking space and location fit.	Methuen, MA	"Design should be appropriate to the location and use. Facilities should be able to be readily identified by electric cars users but blend into the surrounding landscape/architecture for compatibility with the character and use of the site."
May require the parking space to have features that protect charging equipment.	Chelan, WA	"Equipment shall be protected by wheel stops or concrete filled bollards"
	Montgomery County, MD	"Adequate battery charging station protection, such as concrete-filled steel bollards shall be used. Curbing may be used in lieu of bollards, if the battery charging station is setback a minimum of 24 inches from the face of the curb."
May simply specify an entity with the authority to create standards for EV charging stations.	Des Moines, IA	"The city manager or designee is authorized to develop and maintain standards for the design and construction of electric vehicle charging stations."

Model Code Document Name:	
Plug-In Electric Vehicle Best Practices Compendium (County of Santa Clara, CA)	**Recommendation:** Information be given concerning "Parking configurations, including guidance on whether it is preferable to locate chargers in perpendicular, parallel, or angled parking spaces, and on the location of wheel stops, guard posts and signage."

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

Table 6-4. Electric Vehicle Parking Capacity & Minimum Parking Requirements

Typical Ordinance Includes: Specification	Language Example: City, State	Text
Often recommends or requires that a proportion of parking spaces by EV charging stations, designated for EV parking, or be EVSE ready. ● These are often specified as a percent or a ratio. ● May also be based on land uses such as the number of residential units in a development. ● May be based on land use type. ● May limit the number of chargers that can be installed in the right-of-way. ● May include incentives for higher level charging stations through variations in space requirements.	Montgomery County, MD	"The minimum number of electric vehicle charging stations required is 1 electric vehicle charging station per 50 parking spaces."
	Howard County, MD	"For new occupancies subject to this section: at least 1 parking space for each 25 residential units shall feature energized outlets."
	St. Louis Park, MN	"All new or reconstructed parking structures or lots with at least 50 parking spaces, or expanded parking structures or lots that result in a parking lot with 50 or more parking spaces, shall install EVSE as required below. 1. Multiple-family residential land uses shall have 10% of required parking as Level 1 stations for resident parking, and one Level 2 station for guest parking. At least one handicapped accessible parking space shall have access to an EVCS. 2. Non-residential land uses with parking spaces available for use by the general public shall have at least 1% of required parking as Level 2 stations with a minimum of two spaces served by Level 2 charging, with at least one station adjacent to an accessible parking space. In non-residential zoned districts, DC charging stations may be installed to satisfy the EVCS requirements described above on a one-for-one basis."
	Indianapolis, IN	"Two electric vehicle charging stations shall be required for developments that provide 500 or more off-street parking spaces."
	Middletown, CT	"Any new development that requires 25 or more parking spaces, as calculated by Section 40.04 of these regulations, shall have a minimum of 1 charging space or 3% of the total number of spaces allocated to Electric Vehicles (EVs) (whichever is greater) and must have a Level 2 or 3 charging station/connection per EV parking space."
	New Orleans, LA	"No property or parcel may have more than one (1) electric vehicle charger installed in the right-of-way adjacent to such property or parcel."
	Salt Lake City, UT	"A reduction in the minimum number of required electric vehicle parking stalls may be reduced by 25% if a Level 2 station is installed or by 50% if a Fast Charge station is installed. For each additional Level 2 or Fast Charge station installed, the additional reduction will be based on the already reduced number."
May include EV parking space proportion requirements as part of optional financing or a flexible code. ● May be part of a sustainability points system (Duluth, MN). ● May be one of several required amenities to choose from as part of a Planned Unit Development (Golden Valley, MN) ● May be tied to public funding or financial partnership by the city (Saint Paul, MN)	Duluth, MN	"A minimum of 2% of required automobile parking spaces are signed and reserved for hybrid/electric/low energy vehicles in preferred locations near the primary building entrance."
	Golden Valley, MN	(include) "an electric vehicle charging station accessible to residents, employees, and/or the public."

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

Table 6-4. Electric Vehicle Parking Capacity & Minimum Parking Requirements, Continued

Typical Ordinance Includes:	Language Example	
Specification	City, State	Text
May include flexibility on minimum requirements to reduce cost burden.	St. Louis Park, MN	"When the cost of installing EVSE required by this Chapter would exceed five percent of the total project cost, the property owner or applicant may request a reduction in the EVSE requirements and submit cost estimates for city consideration. When City Council approval of the project is not required, the Zoning Administrator may administratively approve a reduction of the required amount of EVSE to limit the EVSE installation costs to not more than five percent of the total project cost."
	Middletown, CT	"Applicants may request a waiver or reduction of electric vehicle parking requirements form the Planning and Zoning Commission during site plan approval."
May require that a proportion of EV charging stations also be made accessible.	Montgomery County, MD	"A minimum of one accessible electric vehicle charging station is required in any parking facility that is required to have one electric vehicle parking space. For parking facilities required to have 51-75 electric vehicle parking spaces will increase to two (2). Between 76-100 electric vehicle parking spaces increases to three (3) and each thereafter increment of 25 electric charging station shall increase by one additional accessible electric vehicle charging space."
May count electric vehicle charging stations towards meeting existing minimum parking requirements for developments (despite being simultaneously restricted to EVs only).	Kansas City, MO	Electric vehicle charging stations may be counted toward satisfying minimum off-street parking space requirements."
	Methuen, MA	"An electric vehicle charging space may count for ½ of a space in the calculation of minimum parking spaces that are required…"
	Indianapolis, IN	"For each electric vehicle charging station provided, the minimum number of required off-street parking spaces may be reduced by two. Each charging station counts toward the minimum number of required parking spaces."
	Chelan, WA	"Electric vehicle charging stations located within parking lots or garages may be included in the calculation of the minimum required parking spaces required pursuant to the Development Standards…"
	Middletown, CT	"Requests for reduction of general parking spaces in exchange for additional EV parking: For any development that exceeds the minimum number of EVCs as required...The reduction of parking cannot be greater than 10% of the total amount of parking for the proposed development."

Model Code Document Name:	
Action Items for EV-Ready Communities (NYSERDA Fact Sheet, Energetics)	**Recommendation:** Require "Set numerical or percentage-based goals... for EV infrastructure in new construction."
Creating EV-Ready Towns and Cities: A Guide to Planning and Policy Tools (NYSERDA, Transportation and Climate Initiative of the Northeast and Mid-Atlantic States, 2012)	**Recommendation:** Create an "Incentive zoning [that] provides a bonus, such as in the form of additional floor area, in exchange for the provision of a public amenity or community improvements... In the case of EVSE, a developer incentive would be exchanged for EVSE prewiring or charging installation."

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

Table 6-5. Electric Vehicle-Designed Parking Use Standards & Protections

Typical Ordinance Includes:	**Language Example**	
Specification	City, State	Text
May state restrictions on what type of vehicle may park in an EV charging station parking space.	Atlanta, GA	"Each electric vehicle charging station and parking space for which any parking incentive was granted shall be reserved for use as an electric vehicle charging station or as electric reserved parking."
	Auburn Hills, MI	"A police agency or a governmental agency… may provide for the immediate removal of a vehicle… in any of the following circumstances...When a sign provides notice that a parking space is a publicly designated electric vehicle charging station, no person shall park or stand any non-electric vehicle in a designated electric vehicle charging station space. Further, no person shall park or stand an electric vehicle in a publicly designated electric vehicle charging station space when not electrically charging or parked beyond the days and hours designated on the regulatory signs posted."
May specify the ramifications for parking unauthorized vehicles in EV charging spaces.	Chelan, WA	"Except when located in conjunction with single-family residences, electric vehicle charging stations shall be reserved for parking and charging of electric vehicles only."
	Kansas City, MO	"Public electric vehicle charging stations must be reserved for parking and charging electric vehicles only. Electric vehicles may be parked in any space designated for public parking, subject to the restrictions that apply to any other vehicle."

Model Code Document Name:	
Alternative Fuel Vehicle Readiness: A Guidebook for Municipalities (North Jersey Transportation Planning Authority , 2017)	**Recommendation:** Municipalities should create enforcement policies for EV parking and charging stations that "specify towing of vehicles in violation of the restriction or impose a fine."

Source: Cooke, Claire and Brian Ross. Summary of Best Practices in Electric Vehicle Ordinances. Great Plains Institute. June 2019.

Permitting

For permitting, the goal is streamlining the administrative process so that it is uncomplicated, fast, and affordable. Efforts to update and streamline permitting should first target reducing and standardizing fees to the consumer. There are several cases of municipalities that have determined existing permitting to be sufficient by defining EVSE installations as "minor" work. Most efforts to expedite permitting have focused on a "standard" single-family home installation, but future efforts should seek to facilitate more complex installations in multifamily and commercial settings.

Partnerships, Procurement, and Agreements

Diverse partnerships in EV-readiness planning strengthens the planning process. Developing expertise and disseminating information is necessary for new techniques to catch on. This shift is often best accomplished by working with organizations dedicated to EVs and businesses that may benefit most from implementing EVSE. Creative business partnerships may be crucial to the future of EVSE deployment. Nurturing business partnerships may reveal new business models that promote EVs and benefit the business community as private-sector innovation will continue to shape the EV market, such as branding opportunities. Finally, the public sector can take an active role and encourage partnership and private business development through procurement policies that include EVs, EVSE charging stations and support services.

There is no one-size-fits-all policy approach to increasing EV readiness. Each state or local jurisdiction needs to evaluate the objectives behind any potential new policy, code revision or other change and follow a path that best suits the jurisdiction.

Integration into Funding Cycles

As part of planning for the future electric vehicle infrastructure and improvements, one of the ways municipalities have moved forward is through its incorporation into Capital Improvement Programs (CIP). Different ways this has been incorporated into CIPs are shown below through the examples of Edina, Minnesota; San Jose, California; Juneau, Alaska; and Santee, California. These locations were chosen to represent areas that did not utilize Congestion Mitigation and Air Quality (CMAQ) funds or other large scale funding sources that are not currently available in the Rockford Region.

City of Edina, Minnesota

The City of Edina identified electric vehicles (EVs) as an important way to reduce transportation emissions. Starting in 2019, a Capital Improvement Project was proposed to put aside up to $25,000 per year for charging stations to catalyze EV adoption. Using these funds, Edina installed Level 2 charging stations, available for free to the public, at a parking ramp. The City currently has future plans to install more stations at city hall and other identified locations. The funding source utilized in this case was the Construction Fund: Available Funding.[iv] As justification for the investment in municipal EV fleets and infrastructure, the Comprehensive Plan's top environmental goals are to reduce GHG emissions 30 percent by 2025 and 80 percent by 2050. To reach these goals, the city has to play both a leadership role in emissions reductions and build the infrastructure to support this.

City of San Jose, California

The City of San Jose has created a label for projects within their Parking Capital Program, called 'Green Technologies and Innovation'. To support the City's green vision goals and provide an enhanced experience for users of the City's parking garages an estimated $3,000,000 has been identified over a 5-year timeframe from the General Purpose Parking Capital Fund. The General Purpose Parking Capital Fund receives funding through parking meter and facility revenues that exceed the amounts needed for ongoing operation and maintenance. This project provides funding to implement environmentally conscious and innovative improvements at the City's parking garages such as LED lighting, rooftop solar arrays, solar powered electric vehicle charging stations, and dynamic message signage.[v]

City of Juneau, Alaska

Juneau, Alaska has planned projects for electric vehicle policy and charging infrastructure along with upgrades for electric transit needs. These upgrades and installations are performed through funding from the area-wide Street Sales Tax. According to the FY2021-2026 CIP, the city expected to install additional electric bus charging infrastructure (bus barns) over various fiscal years and to conduct an EV policy and charging infrastructure project each fiscal year.[vi]

City of Santee, California

The final example of how municipalities have incorporated electric vehicle charging stations into their CIPs is the City of Santee, California. Santee has created a project for the purchase and installation of electric vehicle charging stations at various locations to meet the needs in the community. The first installation is planned for Mast Park in FY 2019-20, with the anticipated installation of two EV charging stations each fiscal year thereafter at city-owned facilities. This project will provide vehicle charging capabilities in an effort to meet the Santee Sustainability Plan's goal to reduce climate impacts and greenhouse gas emissions. Currently, the City is seeking grant funds for the planning and construction of the proposed facilities.[vii]

These municipalities show various funding resources that were utilized to begin integrating electric vehicle infrastructure and sustainability goals into funding cycles. Moving forward the Rockford Region will need to determine the best funding options for the region.

Funding Opportunities

The State of Illinois and the federal government currently offer or and have proposed a variety of funding opportunities earmarked for transportation-related emissions reductions or electric infrastructure improvements. The U.S. Department of Energy and the U.S. Department of Transportation have published a guide to highlight examples of federal support and technical assistance for plug-in electric vehicles (PEVs) and charging stations. The guide provides a description of each opportunity and a point of contact to assist those interested in advancing PEV technology. It also provides a list of current tax credits and incentives applicable to PEVs and EV charging. The Department of Energy's Alternative Fuels Data Center also provides a comprehensive database of federal and state programs that support plug-in electric vehicles and infrastructure. Several of these are highlighted below.

Volkswagen Settlement Funds

The Illinois Environmental Protection Agency (Illinois EPA) has been designated as the lead agency to administer funds allocated to Illinois from the Volkswagen Environmental Mitigation Trust. The Trust was established by Appendix D of the VW Settlement. Illinois' initial allocation of funds is approximately $108 million to be used to fund mobile source diesel emission reduction projects. As directed by the Trust Agreement, the Illinois EPA has developed a Beneficiary Mitigation Plan to address Illinois' planned use of the funds. The Illinois EPA held a 93-day public comment period to solicit public input on the draft Beneficiary Mitigation Plan. After consideration of public input, including written comments, survey results, and opinion expressed at the public listening sessions, the Agency finalized the State of Illinois Beneficiary Mitigation Plan: Volkswagean Environmental Mitigation Trust Agreement. The Beneficiary Mitigation Plan was submitted to Wilmington Trust on August 28, 2018.

Illinois Beneficiary Mitigation Plan establishes three overall goals for use of the Trust funds. These goals have not changed between the draft and final versions of the Beneficiary Mitigation Plan.

- Reduce NOx emissions in areas where the affected Volkswagen vehicles are registered while taking into consideration areas that bear a disproportionate share of the air pollution burden, including environmental justice areas;
- Maximize emissions reductions; and
- Maximize and leverage funding.

In the Illinois Beneficiary Mitigation Plan, Illinois EPA has established three priority areas and anticipates funding projects in all three. The priority areas are established to realize emission reductions in the areas where the vehicles were located, where the greatest number of mobile source emissions are located, and where the largest concentration of population potentially disproportionately impacted by mobile source emissions is located.

- **Priority Area 1:** The Chicago metropolitan nonattainment area (Cook, DuPage, Will, Lake, McHenry, and Kane Counties, and Goose Lake and Aux Sable townships in Grundy county, and Oswego township in Kendall county)
- **Priority Area 2:** Metro-East St. Louis non-attainment area (St. Clair and Madison Counties)
- **Priority Area 3:** Seven Counties, each with 1 percent or more of the total affected VW vehicles (Champaign, DeKalb, LaSalle, McLean, Peoria, Sangamon and Winnebago Counties)

The second round of funding through the VW settlement was distributed for FY 2018-2019. When additional funding cycles are made available the information will be found on the Illinois Environmental Protection Agency's website.

Smart Grid Infrastructure Development and Support

The Illinois Science and Energy Innovation Trust (Trust) will provide financial and technical support to public and private entities within the state for programs and projects that support, encourage, or utilize innovative technologies and methods to modernize the state's electric grid. Technologies may include advanced electricity storage and peak-shaving technologies, such as plug-in electric vehicles (PEVs) or devices that allow PEVs to engage in smart grid functions. The Trust also offers assistance for standards development for communication and interoperability of appliances and equipment connected to the electric grid. Electric utilities may voluntarily commit to investments in smart grid advanced metering infrastructure deployment. Participating utilities must consult with the Smart Grid Advisory Council and file a Smart Grid Advanced Metering Infrastructure Deployment Plan with the Illinois Commerce Commission.[viii]

Federal Alternative Fuel Infrastructure Tax Credit

Fueling equipment for natural gas, propane, liquefied hydrogen, electricity, E85, or diesel fuel blends containing a minimum of 20 percent biodiesel installed through December 31, 2020, is eligible for a tax credit of 30 percent of the cost, not to exceed $30,000. Permitting and inspection fees are not included in covered expenses. Fueling station owners who install qualified equipment at multiple sites are allowed to use the credit towards each location. Consumers who purchase qualified residential fueling equipment prior to December 31, 2020, may receive a tax credit of up to $1,000. Unused credits that qualify as general business tax credits, as defined by the Internal Revenue Service (IRS), may be carried backward one year and carried forward 20 years.[xi]

Improved Energy Technology Loans

The U.S. Department of Energy (DOE) provides loan guarantees through the Loan Guarantee Program to eligible projects that reduce air pollution and greenhouse gases and support early commercial use of advanced technologies, including biofuels and alternative fuel vehicles. The program is not intended for research and development projects. DOE may issue loan guarantees for up to 100 percent of the amount of the loan for an eligible project. Eligible projects may include the deployment of fueling infrastructure, including associated hardware and software, for alternative fuels. For loan guarantees of over 80 percent, the loan must be issued and funded by the Treasury Department's Federal Financing Bank. For more information, see the Loan Guarantee Program website and the Alternative Fuel Infrastructure fact sheet.

Next Steps

As this document highlights, there are a large amount of considerations that need to be made when preparing a region or municipality to be electric vehicle (EV) ready. Across the nation, government entities, from the national level down to the local level, are tryng to figure out how the proliferation of these vehicles will impact everything from residential building codes to federal grant programs.

The research and materials found during the first phase of the Electric Vehicle Readiness Plan, and highlighted in this document, will be the framework in which the region will build upon. The second phase is focused internal toward the Rockford Region to better understand the level of acceptance of electric vehicles by the individuals who work and live in the region and determine where local government entities are in the planning process for electric vehicle charging infrastructure. This will be conducted through a series of public surveys and stakeholder meetings during summer 2020.

With the information collected during these two phases, the RPC then began developing the final EV Readiness Plan which was designed for local government agencies to utilize when reviewing and updating local codes and ordinances for commercial and residential development, as well as identifying potential funding mechanisms for electric vehicle charging infrastructure.

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Appendix A: Glossary of Terms

Acroymns & Abbreviations

A

AFC	Alternative Fuel Corridors
AFDC	Alternative Fuels Data Center
AMFA	Alternative Motor Fuels Act
APTA	American Public Transit Association

B

BEB	Battery electric buses
BEV	Battery electric vehicle
BUILD	Better Utilizing Investments to Leverage Development

C

CAA	Clean Air Act
CACC	Chicago Area Clean Cities Coalition
CAFE	Corporate Average Fuel Economy
Caltrans	California Department of Transportation
CAV	Connected and autonomous vehicle
C-LEAP	Cities Leading Through Energy Analysis and Planning
CMAQ	Congestion Mitigation and Air Quality Improvement Program
CNG	Compressed natural gas
COR	City of Rockford
CRA	Center for Rural Affairs

D

DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation

E

EERE	Energy Efficiency & Renewable Energy
EIA	U.S. Energy Information Administration
EISA	Energy Independence and Security Act
EPAct	Energy Policy Act
EPCA	Energy Policy and Conservation Act
EREV	Extended range electric vehicle
e-Truck	Electric truck
EV	Electric vehicle
EVSE	Electric vehicle supply equipment

F

FHWA	Federal Highway Administration

G

GHG	Greenhouse Gas

H

HEV	Hybrid electric vehicle

I

ICC	Illinois Commerce Commission
ICCT	International Council on Clean Transportation
ICE	Internal combustion engine
ICEV	internal combustion engine vehicles
IDOE	Illinois Department of Energy
IDOT	Illinois Department of Transportation
IEA	Illinois Energy Association
ILCS	Illinois Combined Statutes
Illinois EPA	Illinois Environmental Protection Agency
IRS	Internal Revenue Service
ISTHA	Illinois State Toll Highway Authority
ITS	Intelligent Transportation System

K

kWh	Kilowatt hour

L

LRTP	Longe Range Transportation Plan

M

MFT	Motor Fuel Tax
MOU	Memorandums of Understanding
MPA	Rockford Metropolitan Planning Area
MPGe	Miles per gasoline gallon equivalent
MPO	Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan

N

NACS	Association for Convenience and Fuel Retailing

P

P3	Public-private partnerships
PEV	Plug-in electric vehicle
PHED	Peak hour excessive delay
PHEV	Plug-in hybrid electric vehicle

R

REV West	Regional Electric Vehicle Plan for the West
RMTD	Rockford Mass Transit District
RPC	Region 1 Planning Council

T

the Network	The Northeast Electric Vehicle Network
TRB	Transportation Research Board

W

WSDOT	Washington Department of Transportation

Glossary of Terms

A

Autonomous Vehicle
Also known as self-driving or driverless vehicles, are vehicles in which some aspect of control is automated by the car.
Source: National Highway Traffic Safety Adminstration

C

Charge Port
The charge port allows the vehicle to connect to an external power supply in order to charge the traction battery pack.
Source: U.S. Department of Energy

Clean Air Act
This law defines the U.S. Environmental Protection Agency's responsibilities for protecting and improving the nation's air quality and stratospheric ozone layer.
Source: U.S. Environmental Protection Agency

Complete Streets
A transportation policy and design approach that requires streets to be planned, designed, and maintained to enable safe, convenient, and comfortable travel for all modes of travel. At the core of the complete streets philosophy is the idea that pedestrians, bicyclists, motorists, and public transportation users of all ages and abilities are able to safely move along and across a street.
Source: U.S. Department of Transportation

Compressed Natural Gas
Produced by compressing natural gas to less than 1% of its volume at standard atmospheric pressure.
Source: U.S. Department of Energy

Congestion Mitigation And Air Quality Improvement Program (Cmaq)
The CMAQ program provides funds to States for transportation projects designed to reduce traffic congestion and improve air quality, particularly in areas of the country that do not attain national air quality standards.
Source: U.S. Department of Transportation

Connected Vehicle
A connected vehicle has internal devices that allow it to connect to other vehicles or with an external infrastructure system.
Source: Federal Highway Administration

D

DC Fast Charging Equipment
Direct-current (DC) fast charging equipment (typically 208/480V AC three-phase input), enables rapid charging along heavy traffic corridors at installed stations.
Source: U.S. Department of Energy

E

Electric Vehicle
Vehicles that use a battery pack to store the electrical energy that powers the motor. Also referred to as battery electric vehicles.
Source: U.S. Department of Energy

Electric Vehicle Supply Equipment
All equipment needed to deliver electrical energy from an electricity source to a plug-in electric vehicle battery.
Source: U.S. Department of Energy

Emissions
Emissions are defined as harmful, polluting gases that affect the Earth's atmosphere.
Source: U.S. Environmental Protection Agency

G

Greenhouse Gases
Gases that trap heat in the upper atmosphere are defined as greenhouse gases (e.g. Carbon Dioxide, Methane, Nitrous Oxide, and Fluorinated Gases).
Source: U.S. Environmental Protection Agency

H

Hybrid Electric Vehicle
Vehicles powered by an internal combustion engine in combination with one or more electric motors that use energy stored in batteries.
Source: U.S. Department of Energy

I

Intelligent Transportation Systems (Its)
The application of advanced technologies to improve the efficiency and safety of transportation systems.
Source: Federal Highway Administration

Internal Combustion Engine
A conventional vehicle motor that burns fossil fuel in a chamber in the presence of air.
Source: U.S. Department of Energy

K

Kilowatt Hours
A measure for electricity use
Source: U.S. Department of Energy

L

Land Use
Land use is a term used to describe the human use of land. It represents the economic and cultural activities (e.g. agricultural, residential, industrial, mining, and recreational) that are practiced at a given area.

Source: U.S. Environmental Protection Agency

Level 1 Charging Equipment
Alternating Current (AC) equipment that provides charging through a 120 volt (V) AC plug.

Source: U.S. Department of Energy

Level 2 Charging Equipment
Alternating Current (AC) equipment that offers charging through 240V (typical in residential applications) or 208V (typical in commercial applications) electrical service.

Source: U.S. Department of Energy

M

Metropolitan Planning Area
The geographic area in which the metropolitan transportation planning process required by 23 U.S.C. 134 and section 8 of the Federal Transit Act (49 U.S.C. app. 1607) must be carried out.

Source: Federal Highway Administration

Metropolitan Planning Organization
A regional policy body, required in urbanized areas with populations over 50,000, and designated by local officials and the governor of the state to carry out the metropolitan transportation requirements of federal highway and transit legislation.

Source: Federal Highway Administration

Miles Per Gallon Of Gasoline Equivalent
Miles per gallon of gasoline equivalent (mpge) represents the number of miles a vehicle can travel using a quantity of fuel with the same energy content as a gallon of gasoline (33 kilowatt-hours).

Source: U.S. Department of Energy

N

Natural Gases
An odorless, gaseous mixture of hydrocarbons—predominantly made up of methane (CH4).

Source: U.S. Department of Energy

P

Plug-In Hybrid Electric Vehicle
Vehicles that use batteries to power an electric motor and use another fuel, such as gasoline or diesel, to power an internal combustion engine or other propulsion source.

Source: U.S. Department of Energy

Public Private Partnership
Contractual agreements between a public agency and a private entity that allow for greater private participation in the delivery of projects.

Source: U.S. Department of Transportation

W

Well-To-Wheels
Analysis of energy use and emissions from the primary energy source through vehicle operation.

Source: U.S. Department of Energy

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Additional Resources

Region 1 Planning Council Website
http://r1planning.org/

2050 Metropolitan Transportation Plan Webpage
http://r1planning.org/mtp

2050 Metropolitan Transportation Plan for the Rockford Region
http://r1planning.org/mtp

RPC | REGIONAL PLANNING COUNCIL

R1

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