Charging Lawrence: Electric Vehicle Charging Stations Plan

November 2023

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Acknowledgements

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Glossary

Alternating Current (AC) – The type of electric current used for charging electric vehicles.

Alternative Fuel Corridor (AFC) – Identified routes with dedicated recharging stations for electric vehicles.

Amps (Amperes) – A unit of electric current in the International System of Units (SI). It is the measure of the rate of flow of electric charge through a conductor.

Average Daily Traffic (ADT) – The average number of vehicles through a roadway or corridor within a 24-hour period.

Battery Electric Vehicle (BEV) – An electric vehicle that relies only on electric power from a battery.

Charge Point Operator (CPO) – An entity in the electric vehicle charging ecosystem. CPOs are responsible for the management, operation, and maintenance of electric vehicle charging stations.

Direct Current Fast Charging (DCFC) – A faster charging method compared to AC for electric vehicles, delivering high-voltage direct current to the battery.

Electric Vehicle (EV) – A vehicle powered by one or more electric motors using electricity stored in a battery or obtained from an external source.

Electric Vehicle Charging Station (EVCS) – A location with charging equipment allowing electric vehicles to be plugged in for recharging batteries.

Electric Vehicle Supply Equipment (EVSE) – The infrastructure and equipment necessary for connecting electric vehicles to a power source for recharging batteries.

E-Mobility Service Provider (EMSP) – A participant in the electric vehicle charging network. EMSPs offer various services to electric vehicle users, such as access to a network of charging stations, payment processing, and real-time charging information.

Environmental Protection Agency (EPA) – The federal department responsible for environmental related policies and programs in the United States.

Federal Highway Administration (FHWA) – A division of the USDOT responsible for the national highway system.

Kilowatt-Hour (kWh) – A unit of energy used to measure the energy stored in an electric vehicle battery.

Level 1 Charging – The basic and slowest level of electric vehicle charging which uses a standard household power outlet, 120 volts AC.

Level 2 Charging – A faster charging option for electric vehicles which requires a dedicated charging station of equipment, 240 volts AC.

National Electric Vehicle Infrastructure (NEVI) – A program, under the FHWA, that seeks to connect the country through connected alternative fuel corridors.

Plug-in Hybrid Electric Vehicle (PHEV) – An electric vehicle that combines an internal combustion engine with an electric motor and battery, allowing the vehicle to operate on both electricity and conventional fuel.

Traffic Analysis Zone (TAZ) – Unit of geography most used in travel demand modelling.

Travel Demand Model (TDM) – A tool used to forecast travel behavior and estimate future travel demand.

United States Department of Transportation (USDOT) – The federal department responsible for transportation related policies and programs in the United States.

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Executive Summary

Electric Vehicles (EVs) are coming! Planning for Electric Vehicle Charging Stations (EVCS) is more than understanding new technology. It's amending the City of Lawrence's guiding documents, performing site selection and feasibility, future-proofing and contingency planning, and understanding the financial considerations and available funding opportunities.

This plan explored national and local trends as it relates to electric vehicles and their charging station needs. With one publicly accessible charging station in the City located at the public library, Lawrence will need to promote and support investment in EV charging stations in order to meet the anticipated need for 80 Level 2 charging ports and 2 Level 3 charging ports by 2030. A gravity model analysis provides recommended locations based on current and projected residential, employment, traffic, and other pertinent data such as traffic volumes along major corridors. This modeling effort also took into consideration equitable distribution of EVCS sites to ensure investment was occurring in historically disadvantaged areas.

In addition to modeling and analysis, we engaged with the community to understand their thoughts, support, and hesitations regarding electric vehicles and the City's role in providing charging stations for the community. Online surveys were disseminated to Lawrence's residents and business owners, flyers distributed at the 4th Fest Parade, 4th Fest, and Lawrence Farmers Market, and stakeholder meetings were held. Key themes included concerns regarding the limited availability of transformers and other equipment as barriers to deploying EVCS, EVCS cost for private developers, local ordinances, feasibility of an electric school bus fleet, and equity in selecting sites. The feedback was used when selecting sites and recommending amenities.

Once the general locations were identified, a qualitative review was performed to find suitable nearby sites. This qualitative review included features such as proximity to power supply, access to interstates, arterials and major collectors, ample supply of existing or potential off-street parking, proximity to disadvantaged communities, proximity to trip generators like parks, retail, and employment centers, and access to multimodal facilities and connectivity within the surrounding area. Of the identified sites, five were chosen as the initial locations for investment. Two locations are on public property, one is located in a redevelopment area called the Trades District, and two others in privately owned shopping centers. The latter four sites can be retrofitted for EVCS installation, where one in the Trades District could be installed during redevelopment. Retrofits cost more than if included in the initial design and construction. Guidance is provided herein on how the City can work with landowners interested in installing this technology, potentially partnering together to leverage local funds to match federal grant opportunities, where it be site-by-site decisions or a greater effort for citywide implementation.

Models were created to show how these EVCS sites could be implemented at the two public locations: Government Center and Community Park. Currently most EV parking spaces are retrofitted from existing parking to accommodate cars that fit in traditional parking space. Future spaces will need to provide service to all types of vehicles, including tractor trailers, pick-up trucks with trailers, buses, recreational vehicles, and other large vehicles that would need to pull through a parking space. The Government Center location provides service for one of these pull through spaces, though other turning maneuvers in the paths in and out of the parking lot would need to be checked for large-vehicle suitability. The two sites are able to include key site design elements such as Level 2 or greater charging level, handicap accessibility, lighting for security, visibility from the road, signage for who to call in an emergency or in the event that the charging units are not functional, and proper parking space dimensions. Other desirable features include protection from the elements, technology such as wi-fi, and future proofing by pouring foundations, installing conduit and cable, and anticipating a power load for future expansion.

In addition to identifying ideal charging station locations, guidance was provided regarding the governance of these stations. Zoning revisions, permitting, and required site elements are discussed with recommendations to develop how-to guides, checklists, and resources for landowners and developers wanting to install these stations on their property.

At the outset, property owners need to decide their level of involvement in the owning and maintaining of the equipment and delivery of the project. Once a site is selected and role selected, one of the first calls a property owner in Lawrence should make is to AES Indiana and initiate electrical service process by submitting an Initial Underground Agreement. The form provides basic information for AES Indiana to review and move forward with providing service. Project schedules should include lead times, particularly for larger projects, as at this time, AES is typically taking approximately six months from the time engineering is contacted to when service begins. Other charging equipment has similar lead times, which should be considered when costing the charging station implementation project.

There are several factors when estimating a EVCS project cost. Capital costs are driven by questions on topics such as type of charger, whether the charger is networked or non-networked, how many chargers per pedestal, and how many chargers per site. Other capital costs involve required (site grading, power supply, lighting/safety measures, accessibility, etc.) and desirable (police callbox, future proofing, overhead protection from weather) site design components. At this time, it is recommended to budget $30,000 per site for these requirements and amenities. Finally, AES Indiana may have costs passed on to the project as well, depending on whether the equipment or work is in front of or behind the meter. In addition to capital costs, there may be soft costs such as permitting delays and equipment logistic issues. Other costs to take note of are operations and maintenance agreements, electricity cost, risk and liability insurance, and the ongoing maintenance of the site and equipment. When preparing Operation & Maintenance (O&M) agreements, it is recommended to have clauses about liability and acceptable limits to service disruptions. This contingency planning is crucial to creating a resilient network of EV charging infrastructure.

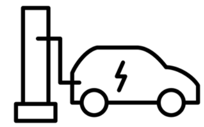
Currently the Return On Investment (ROI) on retrofit sites does not make it enticing to construct EVCS as a primary land use when considering the revenue from charging alone. ROI takes place when other strategies are used in combination, such as subscription/memberships, ad revenue & partnerships, EV Charging As A Service (CaaS). Similar to gas stations with convenient stores, EVCS can increase economic activity at a site, attracting customers by offering an amenity that competitors may not have. In this case, costs are recouped from an increased volume of customer traffic.

To help offset the upfront investment costs of installing EVCS, significant funding opportunities are available. Federal grant programs, tax credits, and rebates from AES Indiana all can lessen the burden and jump start EVCS investment in the community. Through these grant programs and public-private partnerships, the City of Lawrence can make significant progress in providing publicly available charging stations throughout the community.

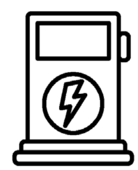
01

EV PRIMER

The EV landscape in which the Charging Lawrence: Electric Vehicle Charging Stations Plan is being developed and will be implemented is complex and rapidly evolving. From rapid advancements in EV technology and exponential growth in consumer demand to federal policies and programs to plan for and deploy EVCS, the pace of progress for EV and supporting infrastructure can be dizzying. In order to establish a working context for this plan, this chapter documents the state of the industry and relevant federal and state policies impacting EV adoption.



History & Current Trends



EV Charging Basics

History & Current Trends

Advancements in and demand for EVs has waxed and waned for decades. Factors like oil prices, gasoline shortages, federal policy, and environmental concerns have generated interest and investment in EVs in the 1970s and 1990s. However, it wasn't until the late 2000s and early 2010s that sustained public and private investment yielded market-ready EVs that could carve out their space in the marketplace. While the Honda Insight and Toyota Prius had brought hybrid electric vehicles (HEVs) into the mainstream in the late 1990s and 2000s, the arrival of the Nissan LEAF in 2010 marked the first commercially successful battery-powered EV and ushered in a wave of EVs to the marketplace. By 2019, there were over 40 models on the market. The expansion of available models beyond light duty vehicles (passenger cars) to include SUVs, passenger trucks, vans, and larger fleet vehicles is increasing EV market penetration.

With the growth in EV models on the market has come an exponential increase in EV sales and ownership. In the five-year period from 2016 through 2021, electric vehicle ownership grew by more than 500%. 2022 experienced a 55% increase from 2021 in EV sales despite total car sales dropping by 8% in that same time frame. A strong first quarter in 2023 saw EV sales increase 60% compared to the same period in 2022.

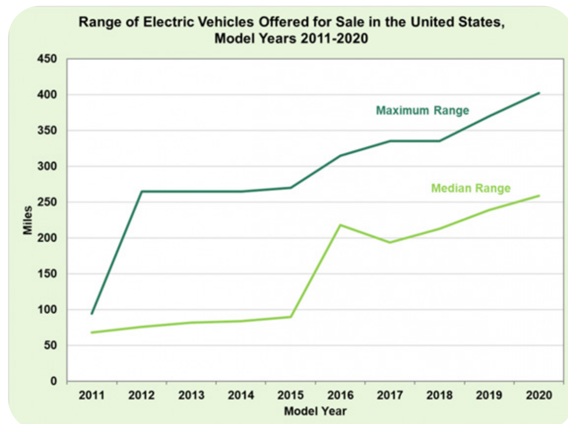


FIGURE 1. EV RANGE, 2011-2020 (SOURCE: US DEPARTMENT OF ENERGY)

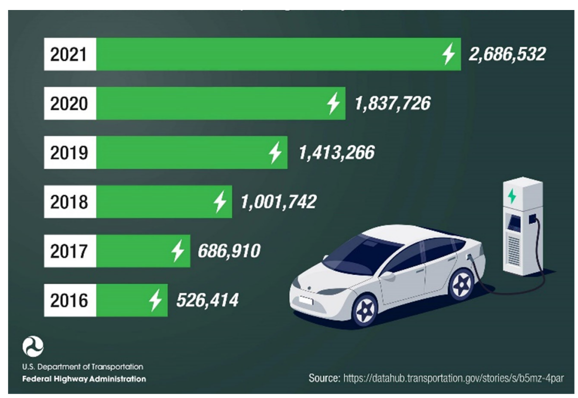


FIGURE 2. ANNUAL EV SALES, 2016-2021 (SOURCE: FEDERAL HIGHWAY ADMINISTRATION)

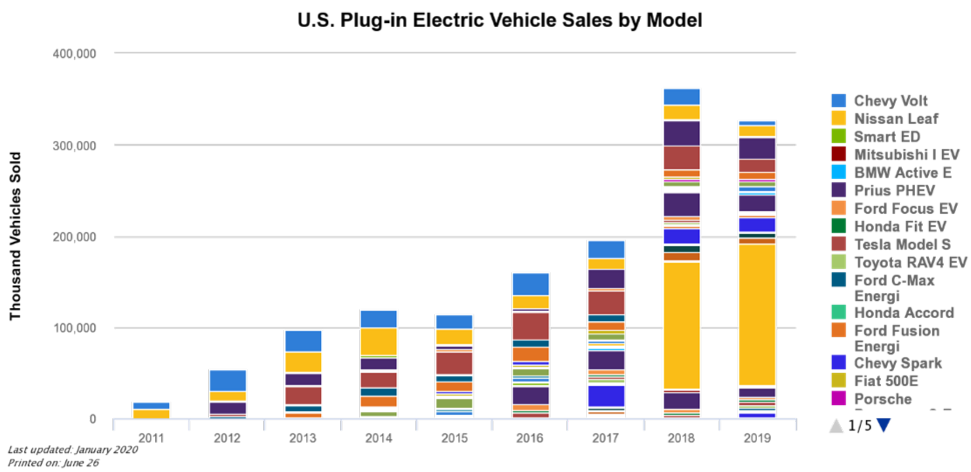


FIGURE 3. EV SALES BY MODEL, 2011-2019 (SOURCE: ARGONNE NATIONAL LABORATORY)

Technological Advancements

The realm of EV has undergone rapid development in the past years, bringing about increased efficiency, practicality, and affordability. At the heart of these technological advancements is battery capacity, which impacts everything from battery size and manufacturing costs to vehicle weight and range. In a 12-year period from 2008 to 2020, the energy density of lithium-ion battery packs has increased eight-fold from 55 watt-hours per liter to 450 watt-hours per liter.

As shown in Figure 1, EV range has benefitted greatly from these advancements, and in turn has eased public concerns about the limitations of EVs, especially for longer trips. In 2011, the median EV range was just 68 miles per charge, with a maximum range of 94. By 2020 median range grew to 259 miles, a 280% increase in just ten years. By 2023, that median figure reached 291 miles per charge, with one model reaching over 500 miles on a single charge.

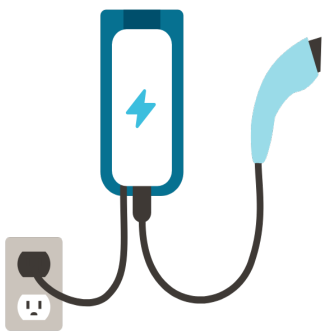
Despite these technological advancements, many US consumers still have concern about vehicle range, often referred to as "range anxiety". This fear is driven by perceptions of insufficient driving range and the availability of public charging infrastructure. Efforts by federal and local agencies to increase public charging infrastructure, particularly fast-charging infrastructure, may help to alleviate range anxiety among consumers in the coming years.

EV Charging Basics

Charging Levels

Just like traditional fueling stations, the infrastructure and design of EVCS are dependent on the specific vehicle types being accommodated and the equipment needed to charge them.

Level 1



AC Level 1 Chargers

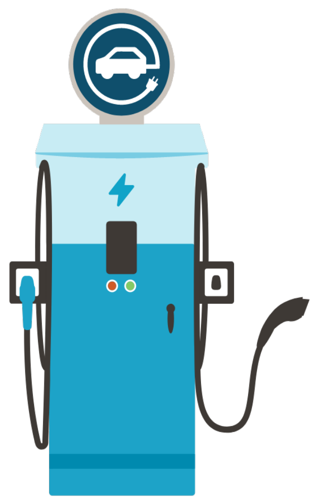
- 120V 1-Phase AC
- 12-16 Amps
- 1.4 to 1.9 kW
- 3-5 Miles per Hour Charging Time

Level 2

AC Level 2 Chargers

- 208V or 240V 1-Phase AC
- 12-80 Amps (typ. 32 Amps)
- 2.5 to 19.2 kW (typ. 6.6 kW)
- 10-20 Miles Per Hour Charging Time

Level 3



Level 3 Chargers Direct Current Fast Charging (DCFC)

- 208V or 480V 3-Phase AC
- <100 Amps
- 50-350 kW
- 60-80 Miles in 20 Minutes

One of the benefits of EVs is the high number of locations that can provide EVCSs. Some of these locations include private residences, multi-family housing, public facilities, fueling stations, and retail destinations. and others. An EVCS can consist of multiple ports used for charging the EVs, like how a traditional fueling station can consist of multiple pumps for multiple cars at a time. However, this isn't always the case and is dependent on the location of the EVCS and its intended use. For example, a private residence may have just one port, while public charging locations often have multiple ports at an EVCS.

Vehicle Design Considerations

Site design for Level 2 and DCFC charging infrastructure varies greatly depending on factors like location, land use context, and intended users. Many charging stations in the Indianapolis region are located in parking lots or parking garages at commercial and retail locations. These chargers accommodate light-duty passenger vehicles (SUVs, sedans, pick-ups).

As more medium- and heavy-duty EVs come onto the market, it will be important for charging stations to accommodate tractor trailers, touring buses, and other large vehicles, taking into account vehicle dimensions, turning radii, and other design factors. Design characteristics of these vehicles will be particularly important for charging stations along designated Federal Highway Administration (FHWA) Alternative Fuel Corridors (AFCs).

Electric Supply Considerations

It's important to note that an increase in demand of EVCS will have a large impact on electric grids, many of which currently may not be able to handle the increased load. This is ultimately a limitation of EVCS installation schedules; therefore, it is highly important for municipalities to proactively collaborate with utility providers, state, and federal agencies regarding the anticipated load.

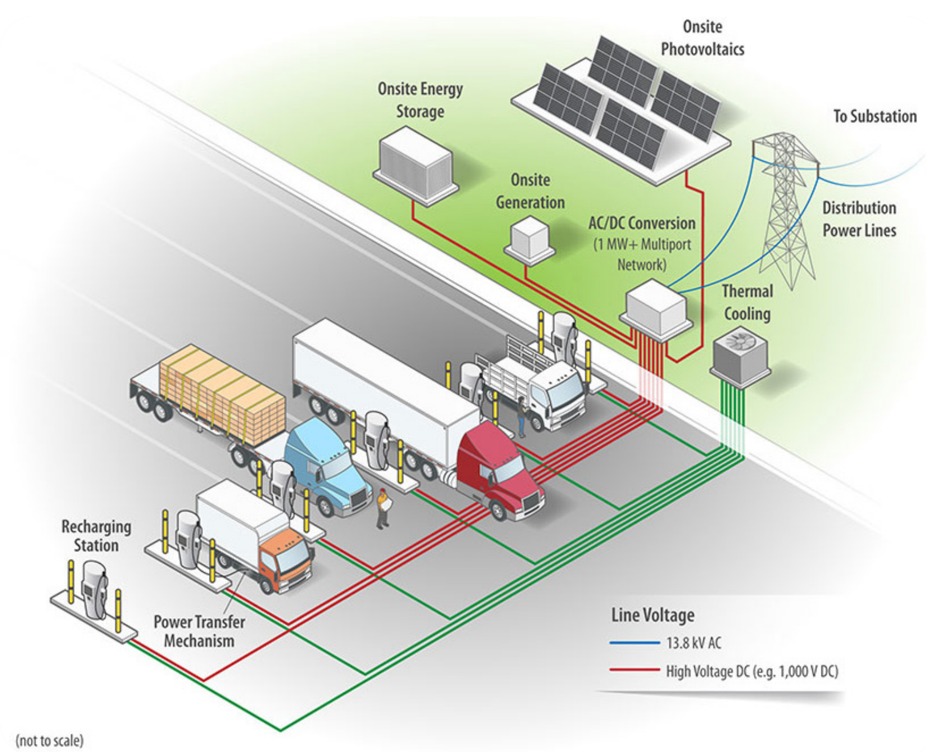


Figure 4. Medium - And Heavy-Duty EV Charging Design Considerations

Policy Framework

With the ever-increasing advancements and popularity of EVs, both federal and state level actors have been working to craft legislation, policies, and plans to support EV manufacturing, incentivize EV ownership, and facilitate the expansion of related infrastructure. Key efforts by these agencies are highlighted below.

Federal Efforts

Multiple federal departments and agencies are working to advance EVs and supporting infrastructure through various funding and grant programs, tax incentives, consumer resources, and technical publications and data to support local efforts. Most closely related to Charging Lawrence is the Federal Highway Administration's (FHWA's) National Electric Vehicle Infrastructure (NEVI) formula program that allocates funding to states for charging infrastructure along EV AFCs, with the goal of creating a nationwide interconnected network of EV charging stations.

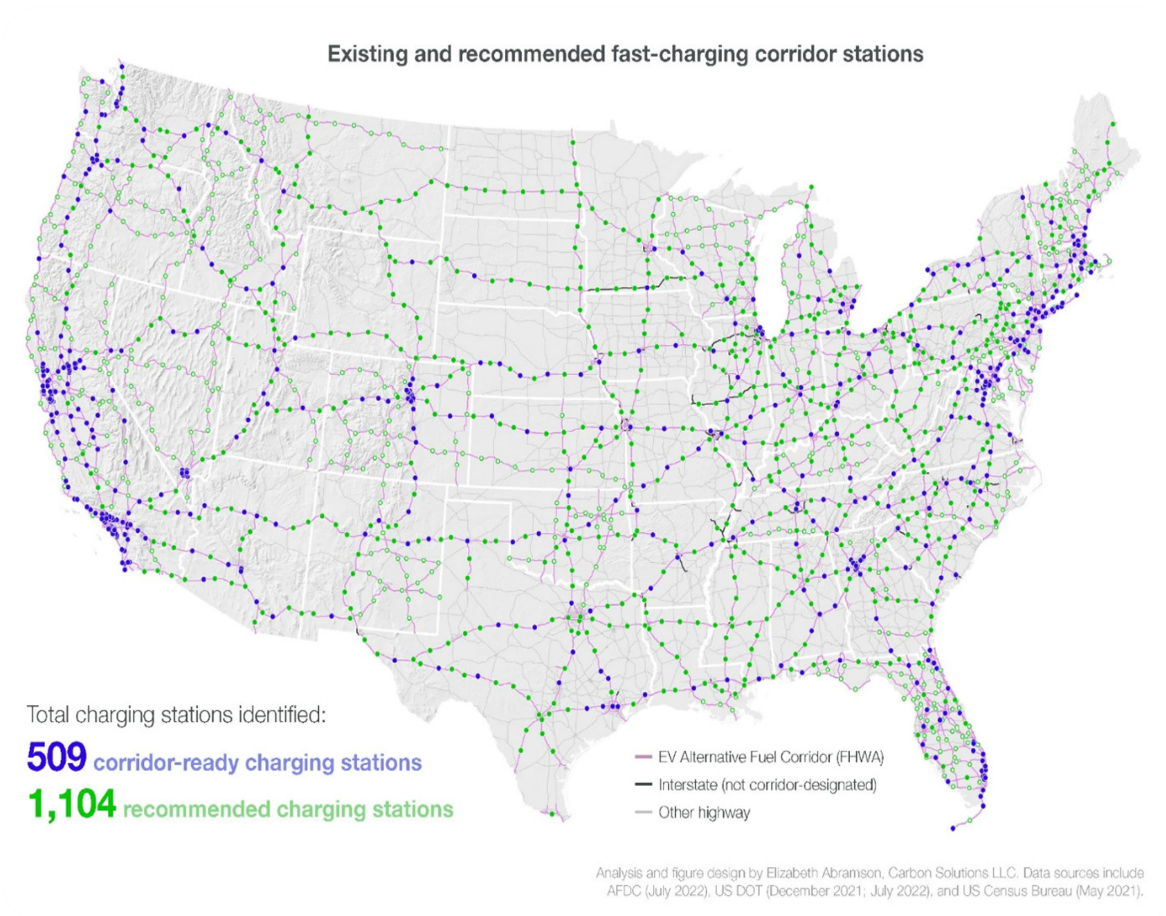


Figure 5. NEVI Identified Alternative Fuel Corridors (Great Plains Institute)

Other Federal Efforts

- **US Department of Transportation (DOT) Urban Electric Mobility Toolkit.** This toolkit is intended for a variety of urban stakeholders, including States, local communities, transportation providers, nonprofits, businesses, and individuals. The toolkit covers infrastructure for different types of electric mobility whether owned individually or shared in a fleet, including light-duty passenger vehicles, micromobility (including electric bikes and scooters), transit and school buses, and medium- and heavy-duty vehicles.
- **US Department of Transportation (DOT) Rural Electric Vehicle Toolkit.** This toolkit is intended for a variety of rural entities, including States, local communities, Tribes, transportation providers, nonprofits, businesses, and individuals. While the toolkit includes some resources for individuals interested in charging their personal EVs at home, the majority of information in this toolkit is most relevant to rural entities seeking to install charging stations for broader public or private use. The toolkit focuses on infrastructure for light-duty electric passenger vehicles, but also addresses funding opportunities and planning considerations for other types of electric vehicles and devices, including micromobility, transit and school buses, medium- and heavy-duty vehicles, and agricultural equipment such as tractors.
- **National Renewable Energy Laboratory (NREL) EVI-X Modeling Suite.** The Environmental Protection Agency's NREL has developed a suite of electric vehicle charging infrastructure analysis tools to help local agencies and researchers plan with network planning, site design, and financial planning.
- **US Department of Energy (DOE) Alternative Fuels Data Center (AFDC).** The AFDC serves as a one-stop shop for information, data, publications, and other tools to support transportation decision makers advance their energy and economic goals as they relate to alternative fuels. In addition to electricity, other fuel sources covered by the AFDC include biodiesel, ethanol, hydrogen, natural gas, propane, and renewable diesel. EV tools and resources include benefits and considerations, EV station location tool, vehicle types, EV laws and incentives by state, case studies, and infrastructure procurement and installation information and checklist.
- **Joint Office of Energy and Transportation (Joint Office) Drive Electric Webpage.** Essentially a clearinghouse of resources across federal agencies and research laboratories, the Joint Office's website provides state and local governments with resources to support EV charging infrastructure planning and investments.

State Efforts

Like most states, Indiana must invest in charging infrastructure to support mass EV adoption. As of June 2023, there are a total of 1,137 public charging ports (766 Level 2, 371 DCFC) at 416 charging stations across the state. As more Hoosiers continue to purchase EVs, the need for charging stations will increase. In 2019, EVs represented a modest 0.68% of the light-duty vehicle market in Indiana. Envisioning a future scenario in which that market share increased to 10%, Indiana would need an additional 16,378 public charging ports (15,537 Level 2, 841 DCFC), representing an increase of more than 1400%.

Under the NEVI program, Indiana is expected to receive around $100 million in Federal funding to support EV charging infrastructure along designated EV Alternative Fuel Corridors (AFCs). In the Fall of 2022, the FHWA approved Indiana's EV Infrastructure Deployment Plan, paving the way for the state to begin contracting with partners for the installation, operation, and maintenance of the EV charging stations. Indiana's statewide EV AFC network consists of all interstates as well as US 31 and recommends charging stations within one mile of strategic interchanges. One of these charging station locations is on the edge of the City of Lawrence at the 56th Street and I-465 interchange. Two additional locations are located within five miles of Lawrence.

In addition to State level coordination with the NEVI program, State legislation and policy are trying to keep up with the growing demand and advancing technologies of EVs. The Indiana House Enrolled Act (HEA) 1221 from 2022 allows individuals owning or operating Electric Vehicle Supply Equipment (EVSE) to charge based on kWh, grants the utility regulatory commission the authority to allow time-varying or alternative price structures, and a list of other EV related policies. Current policies and legislation are subject to the development changes of EV and related infrastructure.

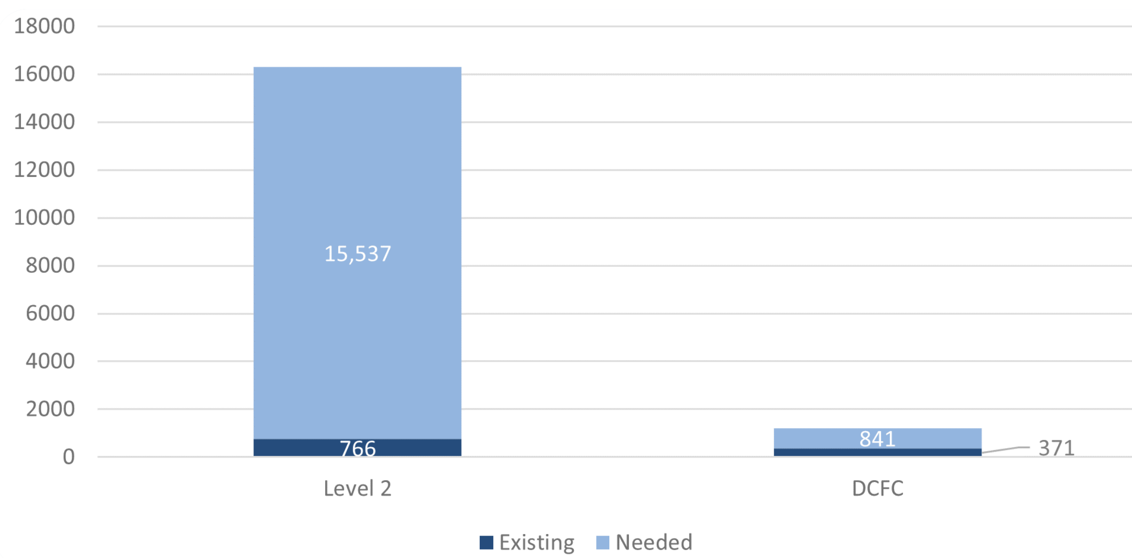
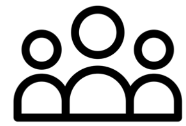


Figure 6. Existing and Needed Charging Ports to Accommodate 10% EV Adoption by 2030

02

ANALYSIS

A multitude of tasks were undertaken in order to inform this plan. Community engagement efforts were employed to gather valuable feedback from workers, residents, and business owners regarding their thoughts and opinions on EV in Lawrence. A supply and demand analysis was completed to better understand where the City of Lawrence should focus its efforts when encouraging the implementation of EVCS. Additionally, recommendations were given to the City of Lawrence regarding their governance after a review of current procedures and policies.



Community Engagement

Supply & Demand Analysis

Governance Guidance

Community Engagement

Stakeholder and community input are vital aspects when creating a plan for a community. An individual's perspective can vary greatly depending on many factors such as career, organization, demographics, and many others. A community is a conglomerate of multiple individuals with unique concerns, ideas, and opinions, which is why input from stakeholders and the broader community are integral to informing the City of Lawrence's plan on EV charging.

Engagement Methods

The City of Lawrence used grassroots outreach efforts to engage Lawrence community members and leaders as part of the Charging Lawrence initiative. With a focus on seeking insights, suggestions, and preferences related to the future of EVCS in the city, the team used the following outreach tactics to maximize engagement opportunities.

Online Presence

Online content relating to the plan was shared on the City of Lawrence's website starting on June 2nd. In addition to this, content was also shared on the city's social media platforms on June 5th, June 15th, and July 12th.

One-Page Flyers

The City of Lawrence created flyers describing the Charging Lawrence initiative, which included QR Codes to easily link to the resident/visitor survey and the business survey. These flyers were distributed at the 4th Fest Parade (July 3rd), 4th Fest (July 4th), the Lawrence Farmers Market (July 6th), and via email. Leftover flyers from these events were used by the city as appropriate. The flyer was also provided to everyone invited to the stakeholder meetings, as well as all members of the Chamber of Commerce.

Surveys

The City of Lawrence created two extensive community surveys to help guide the Charging Lawrence team and planning process. One survey was targeted to residents/visitors, and the other targeted local businesses. The survey links were shared in every engagement touch-point – from flyers and stakeholder groups to emails and in-person discussions with the public. During the period that the surveys were open (49 days), a total of 125 residents/visitors completed the survey, and 9 business surveys were submitted.

Pictures/space for Open House section

Pictures/space for Open House section

Stakeholder Groups

The City of Lawrence redevelopment Commission and Steering Committee identified a list of approximately 50 key community stakeholders – and included minority organizations, churches, schools, economic development organizations, civic organizations, disability groups, local VFW posts, private sector business representatives, federal organizations, quasi-public organizations, and local community organizations.

To maximize the opportunity for robust, focused conversation, stakeholders were divided into five groups for the stakeholder calls. These calls took place on June 26th, June 29th, and July 10th. Those who couldn't attend their assigned group call on the specified date/time was offered the opportunity to participate in a "make-up" call on July 12th.

After multiple rounds of emails and follow-ups, a total of nine organizations participated in these calls. All stakeholders also received multiple reminders with links to the resident/visitor survey and the business survey. The organizations that participated in the calls included:

- Benjamin Harrison YMCA
- Envoy
- Foamcraft
- Greater Indianapolis NAACP Branch #3053
- Greater Lawrence Chamber of Commerce
- Indianapolis Public Library
- IndyGo
- MSD of Lawrence Township
- RaceTrac

Pictures/space for Open House section

Pictures/space for Open House section

Engagement Results

Through the two community surveys, valuable information was gathered from residents, visitors, and local businesses. The City of Lawrence received 125 responses to the survey geared toward residents and visitors and 9 responses to the business survey.

Residents Survey Results

The City of Lawrence received 125 responses to its survey from residents and visitors. The majority of respondents, 83%, live in Lawrence. 17.5% of respondents reported having either an electric or plug-in hybrid electric vehicle in their household. Of those with an electric or plug-in hybrid electric vehicle, nearly 79% reported having an electric vehicle. When asked whether or not respondents have a plan to purchase an electric or plug-in hybrid electric vehicle in the next 5 years, 40% responded no while 38% responded yes but are unsure of when. 56% of respondents reported that EVCS access in Lawrence would increase the likelihood of a future purchase of an electric or plug-in hybrid electric vehicle.

When asked to identify obstacles to EV charging, 77% of respondents identified charging station availability, 55% chose time and frequency needed for charging, and 52% chose cost of EV. When asked about criteria to use to prioritize new EV charging infrastructure locations in Lawrence, the top choices were commercial areas, near major workplaces, and near residents' homes. When asked to rank their top six desired amenities at the EVCS, the top choices were overhead lighting, credit card reader or other accessible payment option, CCTV security cameras, emergency call box, extra parking for vehicles waiting to charge, and shade features.

Business Survey Results

The business survey received a total of just 9 responses. Respondents reported managing various types of properties in Lawrence, including offices, institutional locations, retail, and multifamily units. Currently, no respondents provide EV charging for either their employees or for public use. When asked to identify the biggest barriers to installing publicly accessible charging infrastructure, the most common responses included installation cost, management of charging stations and infrastructure, electricity access or capacity, and long-term operating and maintenance.

Stakeholder Focus Groups

The project team held five focus groups with community stakeholders as described above, which included three local businesses, IndyGo, YMCA of Greater Indianapolis, Indiana State Conference of NAACP, and MSD of Lawrence Township. Key themes and discussion topics included the following:

- Concerns regarding the limited availability of transformers and the possibility of equipment and infrastructure upgrades as barriers to deploying EVCS,
- IndyGo's efforts to "future-proof" their fleet with electric buses in order to accomplish its "zero emissions transition plan" and the issues surrounding fleet charging,
- Current and future IndyGo routes within Lawrence,
- Customer experience,
- EVCS costs for private developers,
- Local ordinances,
- Feasibility of an electric school bus fleet, and
- Equity as a consideration for identifying and prioritizing EVCS locations.

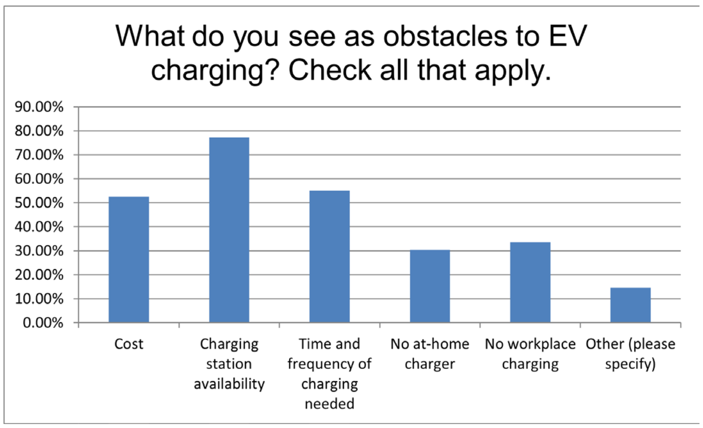


FIGURE 7. RESIDENTIAL SURVEY QUESTION 7 RESPONSES

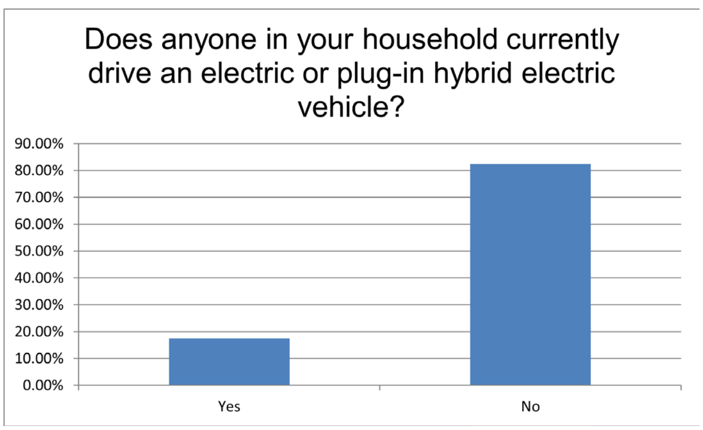


FIGURE 8. RESIDENTIAL SURVEY QUESTION 8 RESPONSES

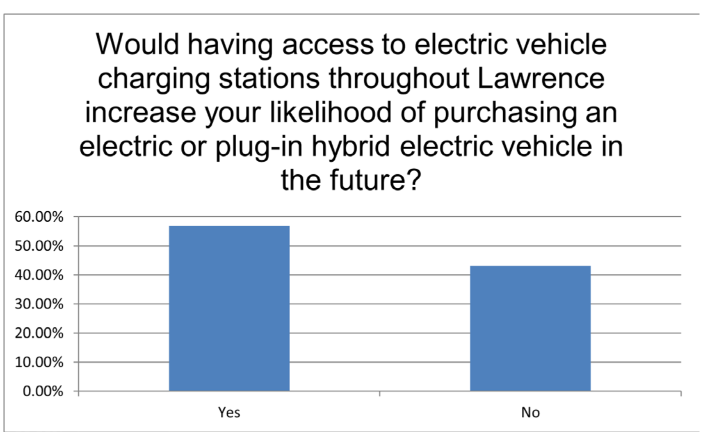


FIGURE 9. RESIDENTIAL SURVEY QUESTION 11 RESPONSES

Supply & Demand in Lawrence

Ideal EVCS site selection is dependent on a multitude of factors, including projected growth and demand, adjacent land uses, site visibility and accessibility, site layout and dimensions, pedestrian infrastructure, and access to the power supply. The site selection process combines a technical, data-driven analysis of current and projected demand and supply with qualitative assessment of EVCS potential site locations and attributes. The City of Lawrence has one publicly available EVCS with many more in the surrounding areas. Within five miles of Lawrence there are three EVCSs (two Level 2 EVCSs and one DCFC EVCS), as shown in Figure 10. The DCFC EVCS has six ports, the Level 2 EVCS to the northwest of Lawrence has one port and the one to the northeast has two ports. Even more options are found within ten and 25 miles of Lawrence, a combination on Level 2 and DCFC only EVCSs, but also EVCSs comprising of both levels.

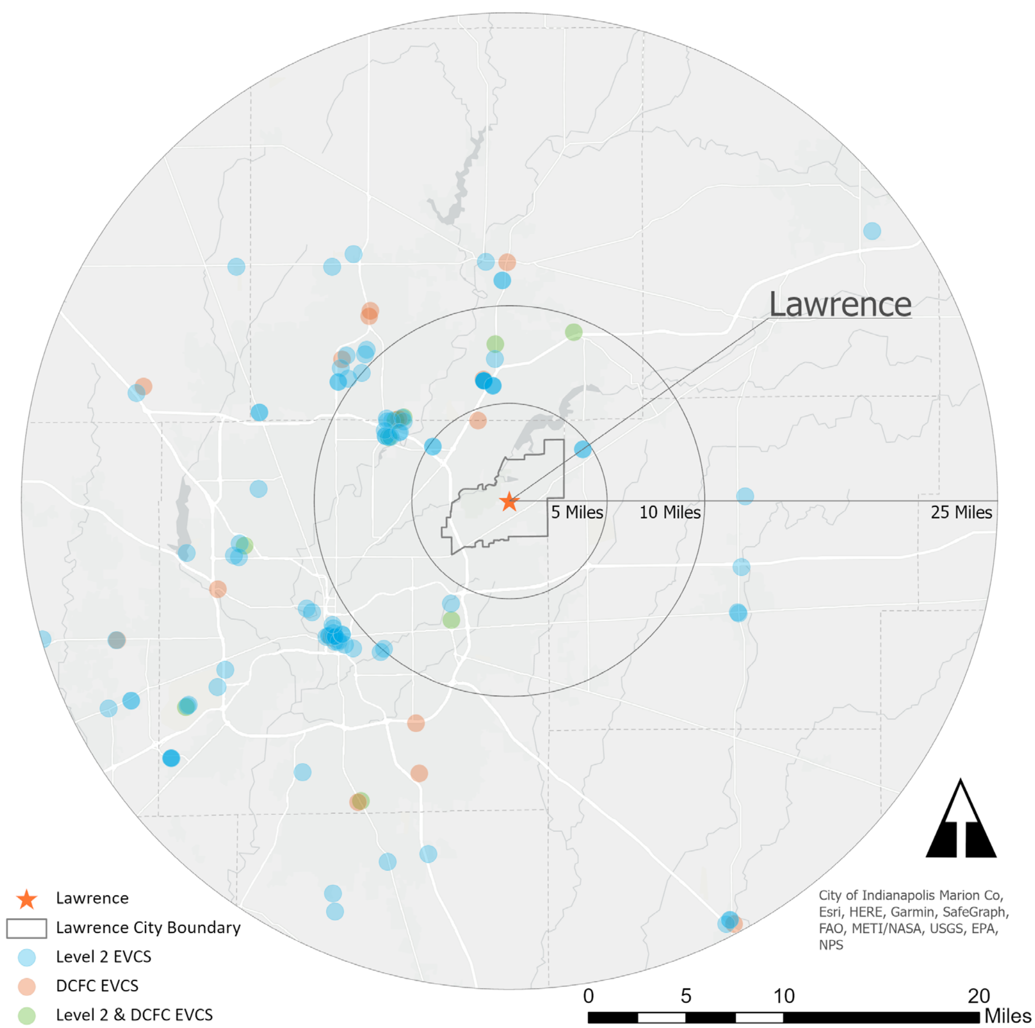


Figure 10. EVCS Locations Around Lawrence

Quantitative Analysis

The EVCS demand and supply model is driven by two key components: (1) EV charging demand or usage, and (2) EV charging station supply. Demand for EVCS was developed based on current and projected residential, employment, traffic, and other pertinent data from the Indianapolis Metropolitan Planning Organization's (IMPO's) travel demand model (TDM). Demand considered for this study focused on public-facing chargers and did not include demand for in-home Level 1 chargers or commercial or institutional EV fleets. Determination of necessary EVCS supply to support current and future demand was calculated with the help of US Department of Energy's Electric Vehicle Infrastructure Planning Tool (EVI-Pro Lite). With an assumption of a twenty-fold increase in EV adoption for the metropolitan area, the City of Lawrence would need approximately 80 Level 2 charging ports and one to two Level 3 charging ports by 2030. This would constitute less than 2.5% of the total regional supply.

These demand and supply data served as key inputs for the station location model, which identifies traffic analysis zones (TAZs) in which future EV charging stations would best meet projected demand. The results of this analysis are shown in Figure 11. The blue squares represent Level 2 Charging Stations to support 2030 projected demand, and red stars represent Level 3 Charging Stations to support 2030 projected demand. It is assumed in this model that each charging station includes three charging ports. TAZs from the travel demand model (TDM) may overlap with neighboring city limits. As such, there are several charging station locations located outside of City of Lawrence. The blue shaded regions of the map represent census blocks which are deemed disadvantaged by the Federal Government's Justice40 Initiative.

It is important to note that this analysis does not take into account factors such as investment cost or power supply, nor does it provide the level of granularity necessary to identify specific locations for EVCS installation. These factors are discussed in the following section.

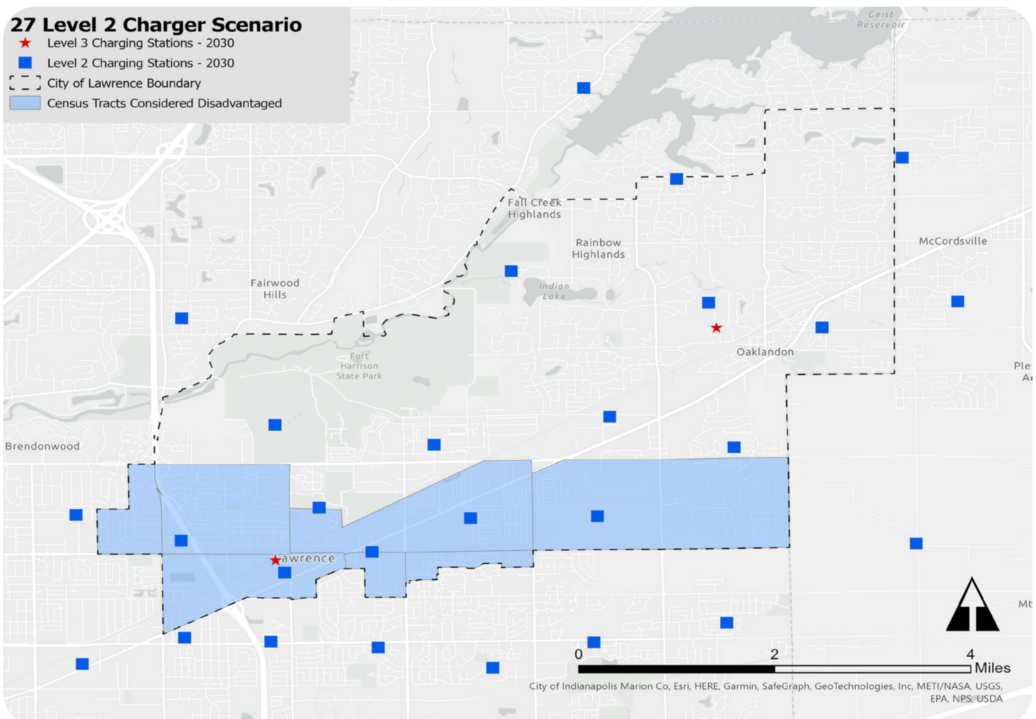


Figure 11. Model Results - Three (3) Level 2 Charging Ports Per Site

Qualitative Analysis

The potential charging station locations identified in the model outputs depicted above were evaluated based on a variety of qualitative factors to determine their viability and inclusion in the five sites to be considered for short-term implementation. Because the model outputs do not provide parcel-level accuracy, properties within the general vicinity of each output were also considered. Evaluation factors included:

- Proximity to power supply
- Site access from interstates, arterials, and major collectors
- Ample supply of existing or potential off-street parking
- Proximity to disadvantaged communities
- Proximity to trip generators like parks, retail, and employment centers
- Multimodal site access and connectivity within the surrounding area

Proposed EVCS Locations

Combining the data-driven demand analysis with a qualitative analysis of potential sites, insight from the steering committee, and other program considerations, the following five EVCS locations have been identified for further site analysis, selection, and project development.

1. Pendleton Pike between Hull Street and Bragdon Street.
2. North Franklin Road and East 52nd Street.
3. North Post Road and East 56th Street.
4. Pendleton Pike and Oaklandon Road.
5. Fall Creek Road and East 79th Street.

Each of these locations are situated along significant arterial corridors and are characterized by commercial and retail uses or City property with generous off-street parking. They also offer direct access to adequate power supply and transformers on-site. The Pendleton Pike site between Hull Street and Bragdon Street is located within a mile of I-465, and this site and the North Franklin Road and East 52nd Street site are located within Disadvantaged Census Tracts. Both of these factors increase their potential eligibility for federal funding sources.

While the locations identified represent starting points for more focused site selection, potential locations like the Government Center and Community Park have been explored in greater detail and are visualized on the following page.

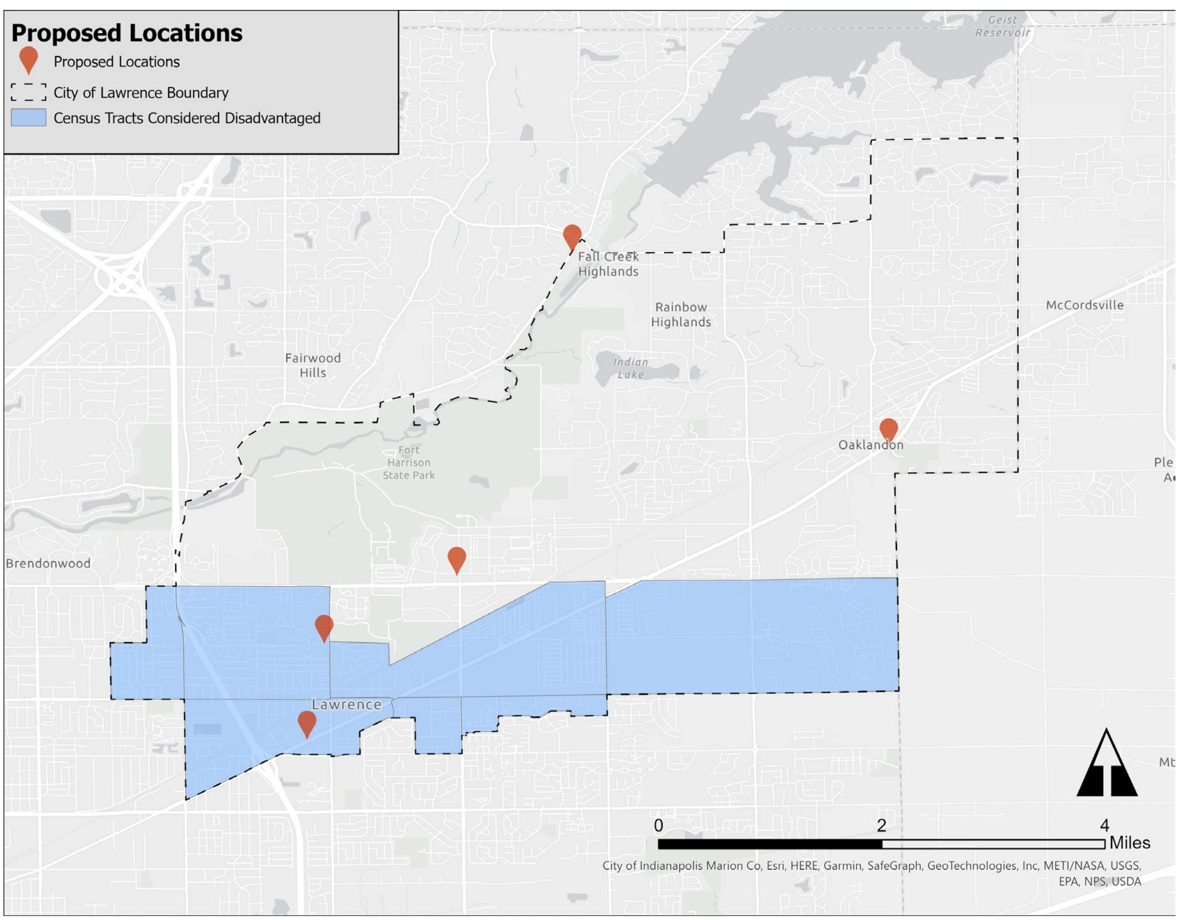


FIGURE 12. PROPOSED EVCS LOCATIONS

Figure 13. Conceptual Rendering of Potential Government Center EVCS Location

Figure 14. Conceptual Rendering of Potential Lawrence Community Park EVCS Location

Figure 15. Conceptual Rendering Potential Government Center EVCS Location at Night

Governance Guidance

Current Operations

As an excluded city under Unigov, the consolidated city-county government for the City of Indianapolis and Marion County, the City of Lawrence has its own mayor and city council, as well as public works department, parks department, police and fire departments, and numerous boards and commissions. Through these departments and commissions, the City of Lawrence has some degree of control over EVCS installations to promote the health, safety, and welfare of the community. These controls include rezoning, variance approval, and building permitting.

Zoning

Land use and development within the City of Lawrence is subject to the 2022 Indy Rezone, the city-county zoning and subdivision ordinance, although the City of Lawrence's Board of Zoning Appeals does have the power to review and issue zoning variances and re-zoning petitions. Other zoning administrative functions like platting and vacation petitions are administered by the City of Indianapolis Department of Metropolitan Development.

EV charging as a land use type is defined within the broader definition of an automobile fueling station, and therefore as a primary use is subject to the same restrictions as other automobile fueling stations that sell gasoline or other fuel sources. However, few existing charging stations within the region have been developed as primary uses. Instead, most are accessory uses and have been installed within existing off-street parking areas. The current zoning ordinance is unclear as to whether EVSE and Make-Ready parking spaces (parking spaces that have been pre-wired to facilitate easy and cost-efficient installation of EVSE) are permitted as accessory uses and accessory structures in any zoning districts.

The zoning addresses EVCS in its parking standards in Chapter 744 Article IV, which requires two EV charging stations for developments that provide 500 or more off-street parking spaces. EV charging stations shall count toward the total required off-street parking spaces. The zoning ordinance also allows developers to reduce minimum parking requirements by providing EV charging stations. For each EVCS provided, the minimum number of required off-street parking spaces may be reduced by two. The cumulative reduction of required parking spaces shall not exceed 35% of minimum number of parking spaces required before applying any adjustments.

Permitting

The City of Lawrence Department of Public Works is responsible for administering residential and commercial building permitting for compliance with applicable codes, including structural, electrical, plumbing, roofing, and related plan reviews, and inspections. EVCS installations will require structural and electrical permits at a minimum.

Recommendations for City of Lawrence

The following recommendations are presented for consideration by the City of Lawrence in order to provide clear and consistent information to residents, property owners, and developers regarding EVSE regulations and permitting.

Develop How-To Guides/Checklists

For property owners and developers, the City of Lawrence will likely be the first point of contact when inquiring about regulations, permits, and procedures pertaining to EVCS installations. As such the City of Lawrence should consider developing a How-To guide for EVCS, similar to what the Department of Public Works has provided for various commercial and residential improvements like basement finishing, roofing, or site plans. An EVCS How-To guide would provide interested parties with an understanding of the regulatory environment and permitting process, the steps necessary to gain approval prior to installation, associated costs, and even external resources on important site development considerations such as utility coordination and compliance with the Americans with Disabilities Act (ADA). A comprehensive example of a permitting checklist was developed by the California Plug-In Electric Vehicle Collaborative, which served as the model for many local agency permitting checklists throughout the state.

Explore Zoning Ordinance Revisions

The current City of Indianapolis Consolidated Zoning/Subdivision ordinance touches on EVCS as it pertains to minimum parking requirements, but little else to determine its permissibility and siting criteria, which may create unintended limitations on EVCS deployment. The City of Lawrence should collaborate with Unigov partners to explore best practices and develop zoning ordinance revisions that clearly and concisely communicate EVCS zoning definitions and provisions for residential and non-residential use. New York City, for example, amended zoning language to define EVSE in conjunction with parking facilities as an accessory use, which allowed EVSE to be located in any drive-in property in a commercial district rather than only at existing fueling station locations.

Project Development & Site Design Resources

The EV landscape is evolving quickly. Federal and state agencies, vehicle manufacturers, EVSE manufacturers, local agencies, and other key stakeholders are contributing to this landscape with new research, technology, and regulations to make EV deployment and adoption safe, viable, and sustainable.

Private developers and site hosts may be seeking resources and information to help understand the regulatory climate and develop successful EVCS projects, and rightfully so. Whether installing EVCS as a primary or accessory use, it is important for developers and site hosts to consider the wide range of factors from project development and scoping to utility, installation, and operations planning. Each of these factors should be evaluated and refined through an iterative process as depicted in Figure 16.

The City of Lawrence should use its website to connect developers, site hosts, and residents interested in EV charging with trustworthy resources to support them in their endeavors. Whether it be USDOT's EVSE project planning checklist, Transportation and Climate Initiative (TCI) of Northeast and Mid-Atlantic State's Siting and Design Guidelines for Electric Vehicle Supply Equipment, US Department of Energy's Alternative Fuels Data Center, or similar reports and resources, the City of Lawrence should devote space on its website to serve as an information hub linking EVSE suppliers with the tools and resources they need to succeed.

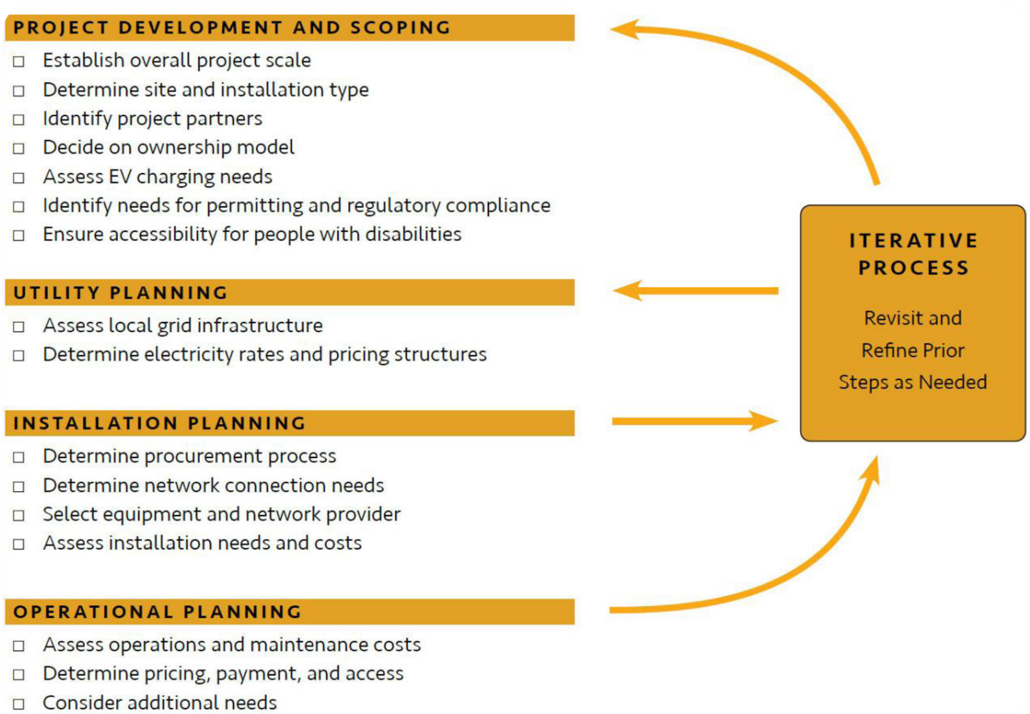


Figure 16. EVSE Project Planning Checklist (Source: USDOT)

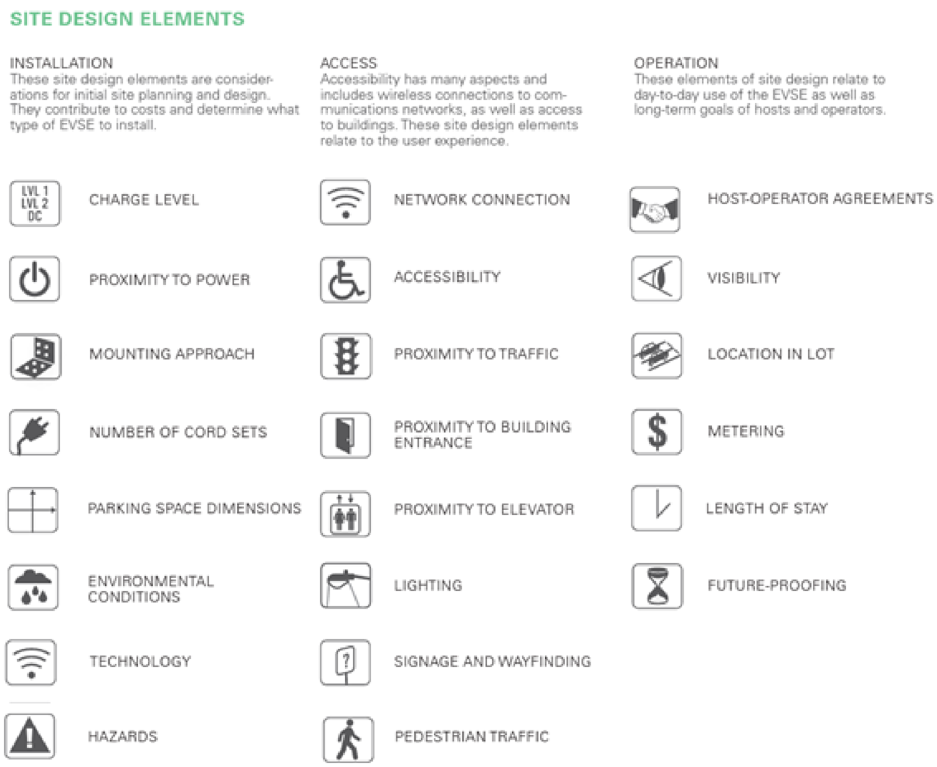


Figure 17. Site Design Elements (Source: TCI Siting and Design Guidelines for Electric Vehicle Supply Equipment)

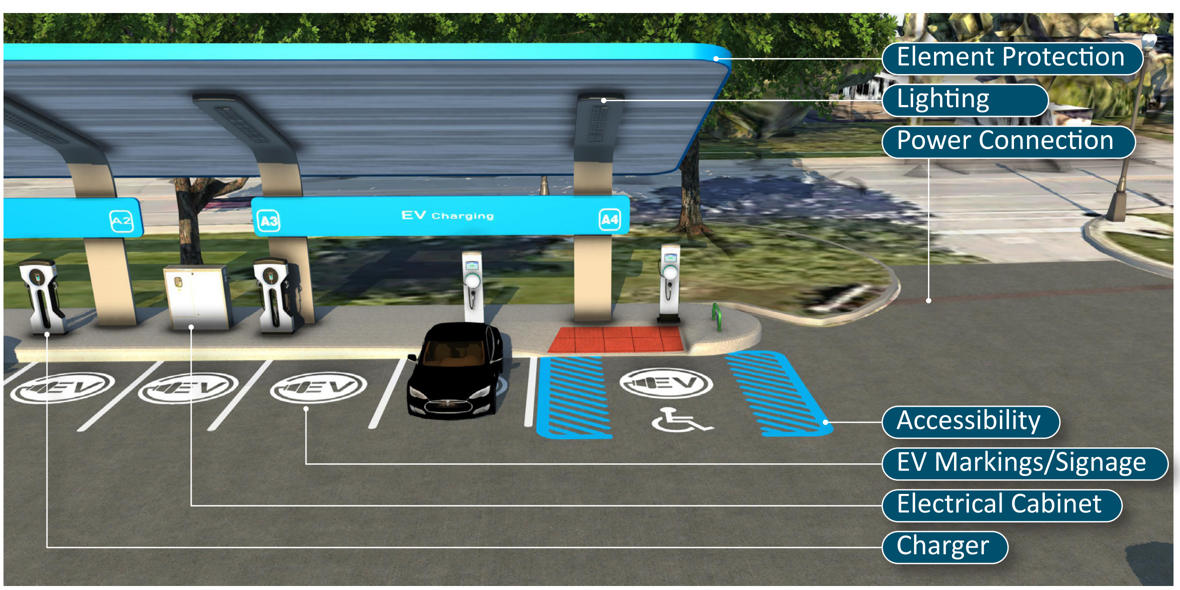


Figure 18. EVCS Diagram Demonstrating Design Elements

Americans with Disabilities Act (ADA)

While the existing ADA standards address many aspects of accessibility for buildings and sites applicable to EV charging stations, the current national ADA standards do not specifically address EV charging stations. To address this gap, the U.S. Access Board issued the Design Recommendations for Accessible EV Charging Stations document. States may also have ADA requirements. For general information on best practices for designing ADA-compliant EV charging stations, we recommend reviewing the guidance in the ADFC's Installing EV in Compliance with the ADA Requirements webpage.

Minimum Standards

FHWA established minimum standards and requirements for all DOT-funded EV charging stations in the National Electric Vehicle Infrastructure Standards and Requirements. DOT-funded programs can be found on the AFDC Laws & Incentives Database which include the National Electric Vehicle Infrastructure (NEVI) Formula Program and the Congestion Mitigation and Air Quality (CMAQ) Improvement Program. It is strongly advised to consult the requirements prior to commencing any project involving the installation and operation of EV charging stations. For more information and to understand how these requirements may apply, we recommend consulting the relevant DOT funding announcement.

EV Charging Station Signage

FHWA defines the minimum standards for signage, which it publishes in the Manual on Uniform Traffic Control Devices (MUTCD). Any signs posted in the public right of way must meet MUTCD requirements. In an effort to promote uniformity, the MUTCD also published the Regulatory Signs for EV Charging and Parking Facilities document. We recommend referring to the AFDC's Signage for EV Charging Stations webpage for information on wayfinding signage and station signage.

National Environmental Policy Act (NEPA) Categorical Exclusions

Before proceeding with funding, authorization, or action implementation, NEPA mandates that federal agencies must assess the potential environmental, social, and economic impacts of the proposed action. The appropriate level of analysis, whether it's an Environmental Impact Statement or an Environmental Assessment, must be determined by federal agencies. EV charging station installation projects funded by the DOT and U.S. Department of Energy (DOE) may fall under categorical exclusions (excluded from detailed environmental analysis) if they align with the criteria outlined here: https://public-inspection.federalregister.gov/2023-20238.pdf. Please note that this categorical exclusion applies specifically to projects funded by DOT and DOE, and not to all federally funded projects.

Partnership Project Screening Criteria

As EV demand continues to rise, the City of Lawrence will be approached by potential partners to develop EVCS installations throughout the community. It will be imperative that the City of Lawrence develop certain criteria to evaluate potential partnerships for EVCS infrastructure development. These criteria should reflect the City's values and goals and provide objective measures by which to transparently screen potential partners and projects. The draft criteria developed as part of this planning process provide a starting point for the City of Lawrence and include many of the qualitative assessment factors used to identify the ideal charging station locations presented earlier in this memorandum. These criteria are presented below in Table 1 on the following page.

The criteria are grouped into six categories: land use and capacity, access to power supply, user access, user experience, equity, and implementation. Along with the criteria are maximum possible scores. Where applicable, a proposed partner project may receive partial points for a particular criterion. The highest possible score a project can receive is 100 points.

The evaluation criteria are in draft format and are being tested in order to calibrate the scoring system and identify guidance on scoring thresholds for project selection.

Table 1. Sample Partner Project Evaluation Criteria

Goals and Themes	Performance Measure	Score
Land Use, Capacity, and Utilization		25
	Level 2	
	Located on-site with or adjacent to land uses where people park for 4 to 10 hours (employment, hotels, multi-family housing, etc.)	15
	4+ charging ports	10
	Level 3/DCFC	
	Located on-site with or adjacent to land uses where people park for 30 to 60 minutes	15
	4+ 150kW chargers	10
Access to Power Supply		15
	Located within 300 feet of a transformer	15
User Access		15
	Level 2	
	Located along an arterial or major collector roadway	10
	Direct access to sidewalks/multi-use paths/transit stops	5
	Level 3/DCFC	
	Less than a 1-mile drive from an Alternative Fuel Corridor (AFC)	5
	Located along an arterial or major collector roadway	5
	Direct access to sidewalks/multi-use paths/transit stops	5
User Experience		15
	Desirable site amenities (24/7 monitoring and customer support, public Wi-Fi, lighting, security features, etc.)	15
Equity		15
	Charging station located within a Justice40 community	15
Implementation		20
	55% American-made components	5
	25% State of Indiana/INDOT registered DBE or City of Indianapolis registered Minority, Women, Veteran and/or Disabled Owned Business (XBE)	5
	Required local match less than $XXX,XXX	5
	Anticipated open date within X months	5
Total Score		100

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03

IMPLEMENTATION

The actual acts of implementing EVCS and providing services can be complex and vary greatly depending on intended use of the site. However, the implementation plan walks through a general outline of the steps to a fully implemented EVCS. Equally as important to the implementation plan are the financial aspects of constructing, owning, and operating an EVCS are provided in this chapter.

The implementation process covers all the checkpoints necessary to begin operations. It includes site selection, utility coordination, EVSE implementation, and O&M agreements.

Implementation Plan

Financials

Implementation Plan

Site Selection

Using the site selection criteria from the previous chapter will help to decide whether a location is a suitable candidate for an EVCS. This initial step is one of the most important as it will help to define services offered, customer base, and impact the overall success of the EVCS.

Below are additional images depicting the model identified potential EVCS locations and their estimated costs. Figure 18 depicts a conceptual EVCS at the Government Center and Figure 19 depicts a conceptual park EVCS location.

Government Center Location

Cost Estimate:

$60K-$70K

Figure 19. Model Identified Government Center EVCS Concept

Park Location Cost Estimate:

$70K-$80K

Figure 20. Model Identified Lawrence Community Park EVCS Concept

Utility Coordination

Lawrence's electrical service provider is AES Indiana. The first step in initiating service is to submit an Initial Underground Agreement. This form requests the basic information relating to the project such as the type of project, electrical information, equipment information, and project and service start dates. This is the basic information which will be reviewed by AES to move forward with providing services.

EVSE Implementation

Once initial contact has been set with AES, choosing between Engineering Procurement & Construction (EPC) or Direct Hire becomes the next step. With EPC, one entity oversees the project from design to delivery. The contractor will handle the engineering aspects such as the site designs, plans, and specifications. The contractor will acquire all necessary materials and equipment. Finally, the contractor will oversee the construction activity until completion. The other possible route is direct hire in which different entities are contracted for various stages of the project and the client is typically responsible for procurement of materials and equipment.

The timeline will depend on the scope of the project, the coordination required, and the state of the supply chain. Lead times for larger projects typically takes AES around six months from the time engineering is contacted to when service begins.

O&M Agreements

Two key components make up the operation and management aspect of an EVCS. The first is the Charge Point Operator (CPO) and the second is the Electro Mobility Service Provider (EMSP). The CPO is responsible for building the EV charging network and equipping the EVCS. The EMSP is the face of the EVCS services and brings the EV charging to the consumers through managing the pricing, billing, and other consumer related processes. The CPO and EMSP can be independent entities, or one company can work as both the CPO and EMSP. If both are separate entities, its common that the EVCS owner will contract the CPO which will contract the EMSP. ChargePoint is an example of a company that acts as both the CPO and the EMSP; however, there are various other companies with such services available and EVSC owners are encouraged to do their due diligence in contracting a CPO.

Financials

Capital Costs

Capital costs are dependent on site location and intended use and comprise of the type of EVSE, site preparation, installation, site amenity costs, and any necessary permits or regulatory compliance costs. The site owner or lessee are typically on the hook for these initial capital costs. The EVSE includes the chargers and pedestals with costs varying by charger type and the number of chargers. As EVSE becomes more ubiquitous, prices may decrease. Certifications are required for the vendors installing (and maintaining) the EVSE.

It's important to go with reputable vendors instead of the absolute cheapest. Reading reviews and speaking with others who have gone through the process are good ways to know if a vendor provides and performs quality work. Going with a cheap vendor may result in less capital cost but may require more money overtime to maintain and upgrade.

When planning for service and installation, it is important to think about future-proofing for any anticipated expansions as the cost for additional materials such as concrete, conduit, and conductor cable to accommodate the potential for future increased service now is less than paying for the whole process again in the future.

EVSE & Installation

Costs for EVSE infrastructure and installation are impacted by multiple factors:

1. **Is it a Level 1, Level 2, or DCFC charger?**

Level 2 stations are approximately 1.5-4.0 times the cost of a typical Level 1 station in a residential single-family home, and a DCFC can be 10-50 times the cost of a Level 2 station.

2. **Is it networked or non-networked?**

A networked charger is connected to the internet and is capable of accepting payment from customers. It can also be remotely controlled for pushing software updates and adjustments to rates. Non-networked stations cannot accept payment and are typically more useful for fleet installations where the chargers are not for public use.

3. **How many chargers per pedestal?**

Similar to a typical gas station pump that has either one or two fueling positions per pump, a charging station pedestal can accommodate either one or two chargers per pedestal. Two chargers may be more economical for installation. However, it should be considered that unlike a gas station pump that can provide the same flow rate of fuel whether one or both fueling positions are being used, if two cars are connected to the pedestal at once, the flow rate of electricity is split in half between the two vehicles.

4. **How many chargers per site?**

Typically, there is an economy of scale with the number of chargers per site, meaning the cost of installation per charger will decrease if you install more chargers per site.

The International Council on Clean Transportation (ICCT) has produced estimated national costs for both charging equipment and installation from 2019, updated to reflect 2023 dollars, which are listed in Table 2, Table 3, and Table 4 on the following pages.

Table 2. ICCT Hardware Costs

Level Type	Chargers per Pedestal	Per Charger Cost
Level 1 Non-Networked	One	$967
Level 1 Non-Networked	Two	$710
Level 2 Non-Networked	One	$1,408
Level 2 Non-Networked	Two	$1,118
Level 2 Networked	One	$3,726
Level 2 Networked	Two	$3,965
DC Fast Networked 50 kW	One	$33,840
DC Fast Networked 150 kW	One	$89,363
DC Fast Networked 350 kW	One	$166,811

Table 3. ICCT Installation Costs (Level 2 Chargers)

Cost Type	# Chargers per Site			
	1	2	3-5	6+
Labor	$1,840	$2,177	$1,962	$1,568
Materials	$1,325	$1,238	$1,516	$1,074
Permit	$98	$74	$70	$45
Tax	$114	$106	$131	$89
Total	**$3,377**	**$3,595**	**$3,679**	**$2,776**

Buy America

The U.S. Department of Transportation (DOT) published a Waiver of Buy America Requirements for EV Chargers in February 2023, which temporarily waives certain requirements under the Build America, Buy America (BABA) Act for DOT-funded EV charging infrastructure to encourage the growth of the domestic EV charging manufacturing industry. DOT's Federal Highway Administration (FHWA) also published a Construction Program Guide with more information on the waiver. Beginning March 23, 2023, the waiver applies to EV chargers manufactured before July 1, 2024, with final assembly in the United States. DOT will begin phasing out waivers in July 2024. It may be worth noting that charging stations covered by the waiver must begin construction by October 1, 2023, or the chargers will be subject to more stringent BABA requirements. For more information, we recommend referring to FHWA's FAQ webpage.

Table 4. ICCT Installation Costs (DCFC Chargers)

Cost Type	Number of Chargers per Site			
	1	2	3-5	6-50
50kW Chargers				
Labor	$22,878	$18,111	$13,345	$8,579
Materials	$30,979	$24,783	$18,588	$12,392
Permit	$238	$179	$119	$60
Tax	$126	$101	$76	$50
50 kW Charger Total	**$54,221**	**$43,174**	**$32,128**	**$21,081**
150kW Chargers				
Labor	$24,021	$19,016	$14,012	$9,008
Materials	$32,528	$26,023	$19,517	$13,011
Permit	$250	$188	$125	$63
Tax	$132	$106	$80	$54
150 kW Charger Total	**$56,931**	**$45,333**	**$33,734**	**$22,136**
350kW Chargers				
Labor	$33,172	$26,261	$19,350	$12,439
Materials	$44,920	$35,936	$26,952	$17,968
Permit	$346	$260	$173	$87
Tax	$183	$147	$110	$74
350 kW Charger Total	**$78,621**	**$62,604**	**$46,585**	**$30,568**

It can be seen in the tables above that there is an economy of scale where the per-unit cost decreases the most chargers you have on a site. This is certainly pertinent for sites with potentially significant amounts of charging use, such as at the convention center, schools and their associated fleets, and Lawrence Community Park, where multiple stations are needed to fulfill demand.

As technology continues to improve, we expect that the cost per charger will decrease faster than inflation would cause it to increase. The prices quoted herein are continually being updated and refined in this EV landscape that is rapidly changing. The prices are our best estimate at this time and can be used for budgeting purposes, but updated prices should be garnered prior to beginning a project.

Site Preparation

In addition to the charging equipment and installation, there are other elements that go into site design and preparation that will add to the overall cost per project. Focusing on "behind-the-meter" components, these can be divided into site requirements vs. site amenities. Items that will be placed in these categories would include but may not be limited to the items in Table 5.

The costs for each site's requirements and amenities have the potential to be significantly different. Currently, it is recommended to budget $30,000 per site for these requirements and amenities. Care should be taken to locate and coordinate with other utilities in the surrounding area to determine potential impacts prior to construction.

Table 5. Additional Site Design Components

Required Components	Amenities
Grading / Leveling of site (as needed)	Public Wi-Fi
Conduit & conductor cable from meter to EVSE	Overhead protection from weather
Concrete pads for EVSE, power supply	Future-proofing the site
Lighting/safety measures	Landscaping
Bollards/protection of EVSE from errant vehicles	Police callbox
Accessible spaces – pavement markings, signage, charger head mounting height & position, accessible path	Wayfinding signage (e.g. to nearby transit, points of interest)
Network access (monthly payment to service provider)	
Instructional signage	
Parking space restriction signage (as needed)	

Electrical Service Provider Costs

Lawrence's electrical service provider is AES Indiana. The first step in initiating service is to submit an Initial Underground Agreement. This form requests the basic information relating to the project such as the type of project, electrical information, equipment information, and project and service start dates. This information is then reviewed by AES to move forward with providing services.

Sites that are desirable for EVCS may not currently be accessed using existing electricity transmission equipment. The cost of new service, setting the transformer and extending three-phase service may require additional right-of-way and the cost may depend on whether the new or extended line can be bored underground or hung overhead. AES provided the following unit costs (current through August 2023) to help with estimating total project costs:

- Transformer Installations
    - 750 kVA - $25,000
    - 1000 kVA - $30,000
    - 1500 kVA - $46,000
- Primary extensions
    - One pole (assume 250 ft between poles) - $9,000
    - One 3 phase riser - $2,500
    - One 3 phase recloser (as needed based on completed engineering design) - $50,000
    - Overhead conductor cable - $15 per foot
    - Underground cable, includes boring - $50 per foot
- Meter – no cost to customer

Whether AES or the site owner pays these costs is based on AES Indiana's rules and regulations providing guidelines for line extensions, including the "30 month revenue test." Additional information regarding these rules and regulations can be found on AES Indiana's website.

Soft Costs

As with any project, the owner and installer need to consider potential soft costs that might arise during the project and identify potential remedies to streamline and de-bottleneck the installation process. Examples of soft costs can include but are not limited to:

- Permitting delays
- Equipment logistic issues
- Complex interconnection processes
- Regulation compliance costs (equipment and framework)
- Engineering revisions due to incomplete or incorrect information

Operations & Maintenance

O&M Agreements

The operation and maintenance agreements are the basis to understand which entity is responsible for which costs. As mentioned previously, the site owner or lessee contract with the CPO who either operates as or contracts with the EMSP. The CPO and EMSP team oversee hardware installation, ongoing maintenance, and business operations. The costs between site owner and CPO/EMSP can vary greatly depending on the company and contract although it's typical that the site owner pay fees to the CPO/EMSP team. These agreements should cover all aspects of EVCS, from installation to operations and maintenance, and who covers costs incurred due to power outages whether the issue is front of the meter or behind the meter. The contract with the EMSP should include clauses such as those in the event of an outage, whether it is equipment malfunction or grid related.

Electricity Cost

The biggest operation cost many people associate with EVCSs is electricity cost. Price per kilowatt hour (kWh) can vary depending on demand and usage and is determined by the servicing power company. With a typical EVCS, the electricity cost is usually paid by the CPO or EMSP. This electricity cost can be marked up with the costs passed on to the customer.

Risk & Liability Insurance

Other costs associated with operations and maintenance includes the service operations, upkeep of EVSE, and risk and liability insurance.

Another risk to consider when choosing a CPO and EMSP is cybersecurity threats. With the influx of EVCS equipment across the United States, this is of growing concern in several areas, including security of customer data and payment encryption, individual EVCS being hacked, as well as their connections to the greater electrical grid. Agreements between the site owner and a CPO and EMSP should clearly state who is liable in these instances.

Ongoing Maintenance

The EVCS will require regular maintenance to ensure it remains in working order for the public to use. For equipment on public property, the City can provide maintenance on its own equipment, or enter into an agreement with an EMSP or a joint CPO/EMSP to take on that maintenance. EVSE installation and maintenance crews are required to hold an Electric Vehicle Infrastructure Training Program (EVITP) certification, a program created and backed by the International Brotherhood of Electrical Workers (IBEW) among other industry leading entities.

It is not uncommon for communities to encourage local educational institutions to provide EVSE maintenance training as this can foster a local pool of talent with knowledge on EVSE upkeep. In the case of Lawrence, this might entail encouraging Ivy Tech or the Metropolitan School District of Lawrence Township to implement such a program.

Contingency Planning

Resiliency Overview

Resiliency is crucial to ensure reliability of service to customers. The EVCS is at the mercy of the utility company, weather, and other extraneous circumstances and should have contingencies in place to address potential disruptions to service. Having plans in place in case of these events is not only worthwhile regarding continuing operations but may also help the site owner avoid fines or penalties depending on the specific agreements with the CPO or EMSP.

Currently, utility companies are not reporting grid infrastructure failure or complications stemming from an increase in the EV adoption rate and the supporting infrastructure. Despite this, potential grid infrastructure complications should not be ignored as there are other sources which can cause disruptions. With most power lines being above ground, weather is a large contributor to these grid complications. The City of Lawrence may experience severe weather in the form of thunderstorms, tornadoes, winter storms, and extreme cold. Each of these severe weather events has the potential to cause power outages. Vandalism is another potential cause of power outages through damage inflicted upon the grid infrastructure. Beyond this, events such as car crashes, fires, and other such incidents all have the potential to cause power outages.

Resiliency solutions are available for assisting during power outages. For example, the company EnviroGen / EnviroCharge provides customers with three different forms of off grid charging options as a choice during an outage, or in areas without the infrastructure needed to provide necessary power for the stations. The Mobile Charging Pod, situated on a trailer, is self-contained and grid independent, whereas the Deployable Charging Pod is similar to the Mobile Charging Pod but is intended for longer deployment. The Truck Mounted Pod is designed for highly mobile fleets. The EV Power Pods are located at various distributors around the country and are deployed from these distributors. The closest distributor to Lawrence is EnviroGen Technologies in Evansville, Indiana.

Other solutions include containerized Mobile Power Stations, as well as using other alternative fuels such as biofuels, natural gas, and hydrogen fuel cells. As EV adoption rates continue to rise, it is reasonable to expect more solutions and alternatives to be offered in the case of grid infrastructure complications.

FIGURE 21. EV POWER POD TRAILER

FIGURE 22. EV BEING CHARGED BY EV POWER POD

Return on Investment (ROI)

Charging Fees

When choosing to charge for providing EV charging, there are multiple pricing structures site owners can select. These pricing structures include charging per session, per hour, per minute, or kWh. Each pricing structure has its own benefits and drawbacks. In addition, as of early 2023 the State of Indiana permits variable rate structures throughout the day. This allows higher rates during times of peak electricity demand such as midday in the summer when air conditioner usage is highest

In August of 2023, 33 EVCSs around the Indianapolis area operating under ChargePoint were identified for a price comparison. The 33 EVCS comprised of all four previously mentioned pricing structures: 15 charged per hour, 10 charged per kWh, four charged per minute, and four charged per session. Of the 15 EVCS charging per hour, two stations charged $10 or more per hour, a stark difference compared to the other 13. Alternatively, it was noted that some sites did not charge a rate; however, these sites were typically inside a parking garage or similar paywall. These sites were also not included in the sample set. Also noteworthy is the DCFC charging rates per minute were double those at Level 2 stations. After removing the two high outlier sites, the rates of the remaining 30 sites resulted in the following:

- The average price per hour was $1.67
- The average price per kWh was $0.32
    - Level 2 Average: $0.22
    - DCFC Average: $0.45
- The average price per minute was $0.05
    - Level 2 Average: $0.04
    - DCFC Average: $0.08
- The average price per session was $1.50

It is expected that pricing regulations and rates will continue to evolve in the coming years as more charging stations continue to come online.

It is not likely that direct revenue from the selling of electricity alone will bring a ROI to individual sites. Many companies in the EVCS business serving as CPO/EMSPs, such as EVGo and ChargePoint, have large scale networks so they thrive on an economy of scale.

When thinking about potential revenue generating from the EVCS, certain assumptions need to be made to have an estimate such as AES charging rate, CPO mark up, number of hours in use per charger, and number of days in use per charger. Together this will result in revenue for AES, the site owner, and CPO. The CPO will likely share their profit with the site owner based on the terms of their agreement. A simplified example using assumptions is provided in Table 6. This shows an ideal example of being in use for 12 hours per day for all 365 days per year.

The CPO's profit may then be reduced based on their agreement with the site owner. To further the example, Table 7 shows a return on investment on four Level 2 Networked charger heads, assuming a service life of 10 years, annual O&M costs of $500, and 3% inflation on both annual O&M and revenue. This example includes broad assumptions which may change depending on each site owner's situation and agreements. Depreciation, amortization, insurance, liability insurance, and contingency fund costs are not included in this example.

This example is also a simplified assessment for smaller stand-alone EVCSs retrofitted into their environment. The cost burden would be less if EVCS equipment was installed from the start with new construction. Also, this does not include cost comparisons or considerations when converting fleet vehicles to EV and the potential for non-networked solar panels to charge said fleets.

Table 6. Simplified Revenue Example Per Charger

Component	Amount	Unit
(a) AES Base Price	$1.00	Per hour
(b) CPO Mark-up	50%	
(c) CPO Charge Rates (a + a x b)	$1.50	Per hour
(d) Customer Daily Usage	12	Hrs per day
(e) CPO Daily revenue (c x d)	$18.00	Per day
(f) Days per year in use	365	Days
(g) CPO Annual revenue (f x g)	$6,570.00	Per year
(h) AES bill (g x (a ÷ c))	$4,380.00	Per year
(i) CPO Potential Profit (g – h)	$2,190.00	Per year

Table 7. Example - Four Level 2 Networked Chargers (2 Chargers Per Pedestal, 2 Pedestals)

Level 2 Networked EVCS	Year		Total
	0	1-10	
Capital Costs (Table 2, Table 3)			
Level 2 Networked ($3,965 each)	($15,860.00)		($15,860.00)
Labor	($1,962.00)		($1,962.00)
Materials	($1,516.00)		($1,516.00)
Permit	($70.00)		($70.00)
Tax	($131.00)		($131.00)
Site Requirements & Amenities	($30,000.00)		($30,000.00)
Annual O&M (assume $500/yr with 3% inflation)	n/a	($5,731.94)	($5,731.94)
CPO Revenue (Table 6 (i)) (assume 3% inflation)	n/a	$25,105.90	$25,105.90
Return on Investment	**($49,539.00)**	**$19,373.96**	**($30,165.04)**

Subscriptions/Memberships

While not yet available in Indiana, Duke Energy is piloting a charging subscription service in North Carolina where customers with EVs can enroll to receive unlimited electricity for their car for a fixed monthly rate in an attempt to bring certainty to the cost of electric vehicle charging. Duke Energy can "talk" directly to the enrolled vehicle through the Open Vehicle Grid Integration Platform (OVGIP), bypassing the need for a meter. A co-benefit of this program is better stability in the electric grid, as a customer can input what level of charge they desire by a certain time, and the energy company can regulate the electricity flow based on that schedule, reducing the impact of charging during peak periods.

This is one example of subscription services, which provide customers with fixed costs, convenience, flexibility, and simplicity in their setup. However, while the price is fixed, it may be expensive and come with hidden costs such as charging outside of the subscription radius and may have issues with inconvenient stations and incompatibility between the car and EVSE.

Regardless, these subscription models would be between EV owners and the EMSP, though it is important for the City to know these types of models exist for awareness when potentially negotiating with a CPO and/or EMSP.

Ad Revenue & Partnerships

Another strategy to help offset the cost is to consider partnerships with local businesses for advertising opportunities and cross-promotions. Using screens on or near the EVCS, paid ads can subsidize the cost of the chargers, making the cost to deploy the units more affordable. In one model, this entailed an EMSP paying the city a rental fee for using public rights-of-way for operating the charging station if they kept all or a portion of the ad revenue or allowed the city free advertising for items such as events, services, or real-time transit information.

EV Charging as a Service (CaaS)

EV CaaS is a turnkey approach to EV charging, being involved in the development of the site from concept to construction. After an agreement between the site owner and a CaaS provider, the CaaS provider would develop the site plan, provide engineering services, manage permits, negotiate with contractor, collaborate with officials and the public, act as the construction inspector, and operate/maintain the site once complete. Due to the risk of poor management, the choice of CaaS manager is of the utmost importance.

Economic Development

While an EVCS, particularly a DCFC station, may not have the potential to turn a profit as a primary land use, the presence of the charging station as a secondary land use may drive economic development for other development on the site. It is often thought of as an additional amenity to attract consumers and give the site host an upper hand over competitors. For example, a hotel chain may be chosen over a nearby competitor if it provided secure overnight charging as an amenity for its overnight guests and the other hotel did not. In many ways, this is similar to how traditional fueling stations operate, with the bulk of the revenue being generated from the sale of goods at a convenience store given the low profit margins from gasoline. Installation of EVCS on a site is considered a sustainable solution and can contribute to achieving corporate sustainability goals and LEED status.

The pricing structure is dependent on the agreements between the site host and CPO/EMSP. If located at a shopping center, commercial building, or multi-family residential building, the site host can disperse the cost of EVCS by including it in the per-square-foot cost of their tenants' leases. An example of where this is justified is a situation where a restaurant or personal service establishment with DCFC EVCS located by a busy interstate receives more customers than their competitors across the street. These types of land uses lend themselves to the amount of time needed for long-distance travelers to take a short break while their car charges. This benefit of drawing more customers can justify a higher lease.

An alternative strategy includes offering charging services at no cost to consumers in the hopes of recouping costs from an increased volume of customer traffic. Ultimately, the method of pricing is typically at the discretion of the site owner to best align with their financial and proprietary goals.

Funding Sources & Incentives

There are a variety of significant funding opportunities available to make investments in EVCS more palatable for Local Public Agencies (LPAs) and private sector investors. External grants can close the funding gap increase the likelihood for a positive return on investment. It is important to note that many of the grant programs are limited to government agency applicants; however, these agencies can partner with one or more private sector partners to increase local match and develop a project or projects substantial enough to develop a competitive grant application.

The funding streams for EVCS are constantly evolving, and the programs listed below are not exhaustive. Additional research should be conducted to determine viable funding opportunities.

Bipartisan Infrastructure Law (BIL)

The Bipartisan Infrastructure Law (BIL), also referred to as the Infrastructure Investment and Jobs Act, established two new programs to support investment in fueling infrastructure for EVs and other alternative fuel vehicles: the National Electric Vehicle Infrastructure (NEVI) Formula Program and the Discretionary Grant Program for Charging and Fueling Infrastructure. The BIL also created the Carbon Reduction Program, which can provide funding for a wide variety of projects that reduce greenhouse gas emissions, including Electric Vehicle related projects.

There are other USDOT discretionary grant programs that can provide funding or financing for EV-related projects, but which are not specifically focused on EV infrastructure. These can include Rebuilding American Infrastructure with Sustainability and Equity (RAISE) and Advanced Transportation and Technologies and Innovative Mobility Deployment, among several others. In addition, federal tax credits are available for new EV charging infrastructure installed by businesses or individuals.

National Electric Vehicle Infrastructure Formula Program

The goal of the National Electric Vehicle Infrastructure (NEVI) Formula Program is to ensure that there are a sufficient number of high-speed EV charging stations, spaced at intervals no greater than 50 miles, along key highways, designated Alternative Fuel Corridors (AFCs), to facilitate long distance travel by EVs. The program provides $5 billion in grant funding for the deployment of publicly accessible level 3 charging infrastructure and to establish a network to facilitate EV charging data collection, access, and reliability.

Potential additional funding through the NEVI program will not be available until all of the state's designated AFCs have been fully built out with charging stations.

Carbon Reduction Program

The Carbon Reduction program (CRP) provides over $1.2 billion per year over 5 years (2022-2026) in grant funding to support projects that will reduce greenhouse gas (GHG) emissions from transportation. Indiana is expected to receive a total of $156 million over the 5-year period.

Charging and Fueling Infrastructure Grant Program

The new Charging and Fueling Infrastructure (CFI) Grant Program will provide $2.5 billion over the next five years for EV charging and other alternative fuel infrastructure along AFCs and in communities.

Alternative Fuel Infrastructure Tax Credit

Under the Inflation Reduction Act of 2022, businesses that install new EV charging infrastructure in certain low-income or non-urban areas are eligible for an alternative fuel infrastructure tax credit of 30% of the cost, or 6% in the case of property subject to depreciation, up to a maximum of $100,000. Eligible projects that meet prevailing wage and apprenticeship requirements are eligible to receive the full 30% tax credit regardless of depreciation status. To receive the credit, fueling equipment must be installed in census tracts that meet at least one of the following conditions:

- Are not in an urban area
- Have a poverty rate of at least 20%
- Have a median family income less than 80% of the state median family income level.

Individuals who place EV charging infrastructure at their homes are also eligible for a tax credit of 30% of the cost of hardware and installation, up to a maximum of $1,000.

AES Indiana EVCS Rebate

AES Indiana offers residential customers a $250 rebate for the purchase of new Level 2 EVCSs. Customers join the EV Managed Charging Program to reduce the demand for inefficient energy sources. Through this program, AES schedules your EV's charging session to occur during periods of lesser energy use, evening out the electric load on their system.

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Appendix A - Modeling Support

Modeling of Current State

In order to determine the location of EV charging stations within the City of Lawrence, a data-driven model approach was developed and applied. This section is going to discuss the data inputs, model development and assumptions, followed by preliminary results and next steps needed to further enhance the model.

Data Inputs

Data was obtained from the Indianapolis Metropolitan Planning Organization's (IMPO) travel demand model (TDM). A TDM incorporates a wide spectrum of information related to regional transportation planning. These models are utilized to assist stakeholders in making informed decisions regarding the potential impacts of proposed plans and policies on the surrounding communities.

Within a TDM, data is aggregated within a geographic unit or boundary, called a traffic analysis zone (TAZ). While TAZs vary in size, they typically range between one (1) to three (3) city blocks but are dependent on the size of the model and amount of information it represents. The more densely populated the area, the smaller a TAZ becomes to ensure a certain level of granularity to the data is represented. A TAZ contains demographic data for the geographic area which it encompasses. Most relevant to this study, TAZs contain fields such as household, population, employment, and traffic related information. The base model does not contain information related to the patronization of commercial, retail, entertainment, or anticipated future developments.

Given the provided data fields from the TDM, three (3) scenarios were developed that align to the various levels of EV charging capabilities:

- Total Population: EV users typically utilize Level 1 chargers within their households, as these chargers utilize a 120-V AC plug.
- Employment Centers: Locations which would benefit from Level 2 chargers. Typically, work or office locations where EV users would park for an extended duration of time.
- Traffic Volume: Locations experiencing an influx of traffic, typically near high traveled corridors or interstates, which would be candidate locations for Level 3 fast chargers. Not only would this benefit the local residents, but also motorists traveling through or passing by the City of Lawrence.

It should be noted, this analysis focuses strictly on public facing EV chargers, as the local residents and citizens of the City of Lawrence would receive the greatest usage impact. Initial feedback from stakeholders indicated that analyzing Level 1 at a residence or home would not be of value to the current study. Similarly, analysis of EV fleets was not included as those would be considered on case-by-case basis, as such a high demand in a single location may have too large of an effect on the gravity model and not represent the needs of the public.

Employment classifications were aggregated for fields which would likely be users of EV vehicles such as Information Technology, Financial Services, Professional Technical, Management, and healthcare. Additionally, traffic volumes were included for TAZs with an average daily traffic volume (ADT) of over 10,000 vehicles per day.

Model Development

Research was conducted to determine if any existing tools are available pertaining to EV charging infrastructure. The US Department of Energy's Electric Vehicle Infrastructure Planning Tool (EVI-Pro Lite) was explored to determine whether tool's capabilities would meet project requirements. EVI-Pro Lite was developed to determine the EV charging requirements and associated load profile necessary to support regional (statewide and metropolitan) adoption of electric vehicles. This tool was deemed inadequate for the current study as it lacks specific data for Lawrence, Indiana.

Hence, an in-house K-Means clustering algorithm was developed to determine the optimal location for EV charging station facilities. This clustering algorithm can be viewed as a gravity weighted model, where the TAZ centroids are utilized as the model data points, with the objective of minimizing the squared deviations between the data points and the Kth cluster, as shown in Figure A-1. The TAZ centroids, or data points, are weighted by an attribute from the TDM data such as population, employment, or traffic volume.

This model assumes the number of clusters or charging stations is predefined. Similarly, this model does not consider other constraints such as charger investment cost or power grid capacity. The model is aggregated to the centroid of each TAZ, hence, dispersion or granularity beyond the TAZ centroid level is not feasible.

Lastly, the clusters or charging locations should be viewed as a station or group of chargers, not as the location of a single charger. Model post processing will be required to determine the number of chargers required at each location given site specific characteristics.

Figure A-1. Diagram of the K-Means Clustering Algorithm

Model Preliminary Results

The K-Means clustering model was applied to the initial TAZ data points with a predefined number of clusters to gather preliminary insights. As stated previously, the focus of this analysis will be on Scenario 2: Clustering by Employment, and Scenario 3: Clustering by Traffic Volume.

Figure A-2 depicts a heatmap of employment by TAZ. As shown, the Trade's District does not appear to be reflected from the TDM data and will be discussed in future next steps. Figure A-4 summarizes the model output of five (5) predefined charging station locations shown in red. As can be seen, a charging station location would ideally be located near the high employment TAZ from the heatmap in Figure A-2, located in the northwest part of Lawrence.

Figure A-3 depicts a heatmap of traffic volume by TAZ. As expected, the TAZs with the highest traffic volume are located along US 36, and most heavily concentrated near the interchange of US 36 with Interstate 465. The model output (Figure A-5) depicts the optimal location for three (3) charging station locations given the traffic volumes within each TAZ. As expected, a charging station is located near the interchange of US 36 with Interstate 465 due to the high traffic volumes of the surrounding TAZs.

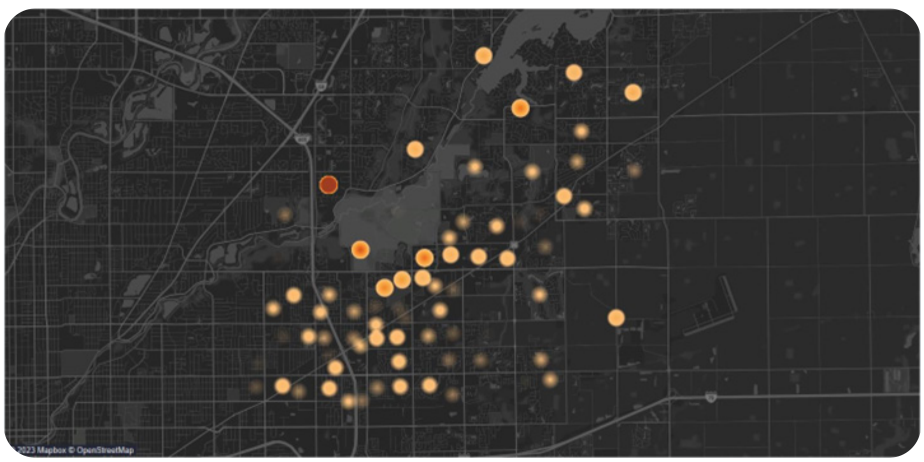

Figure A-2. TAZ Employment Map

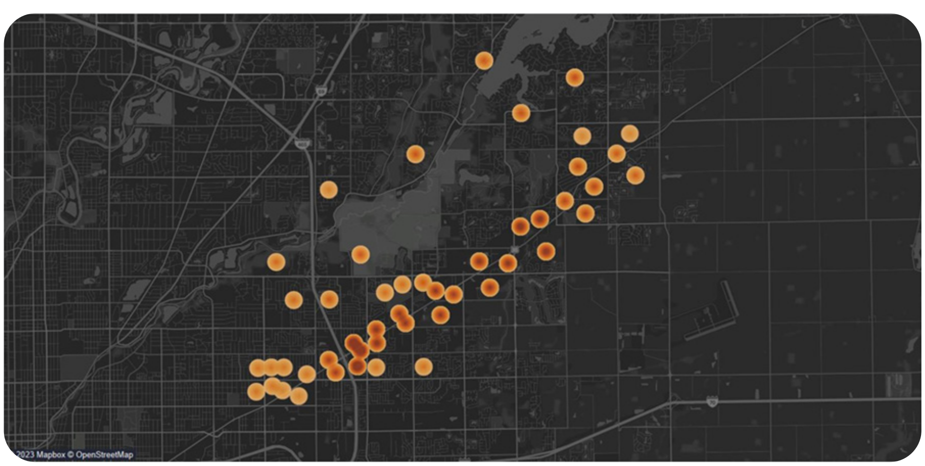

Figure A-3. TAZ Traffic Volume Heatmap

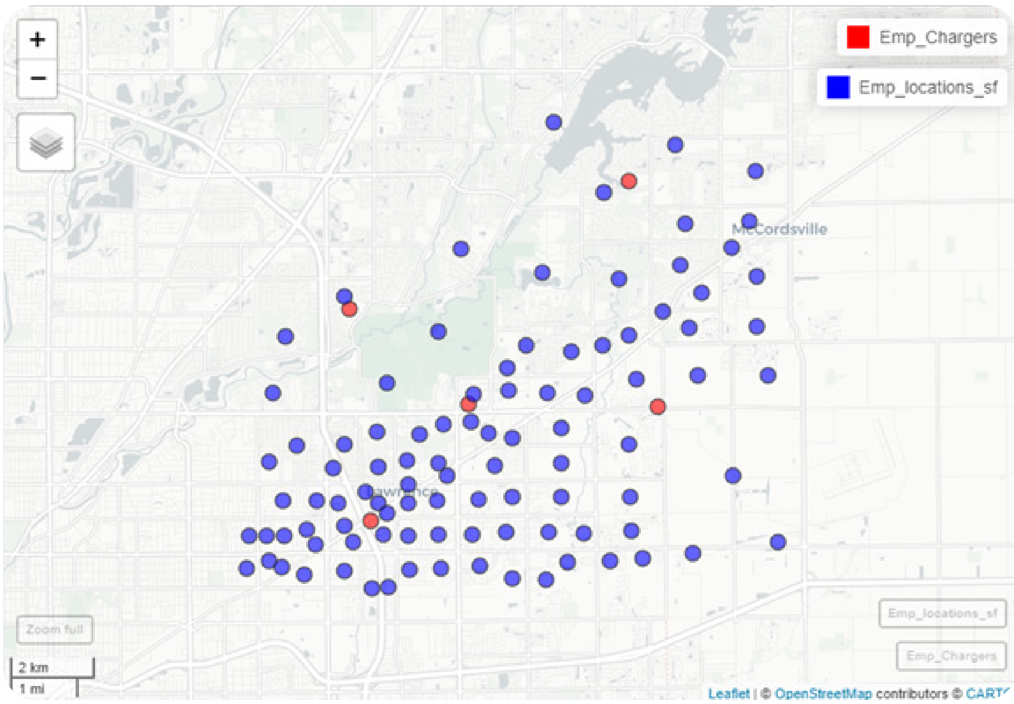

Figure A-4. Scenario 2 Employment-Based Model Output

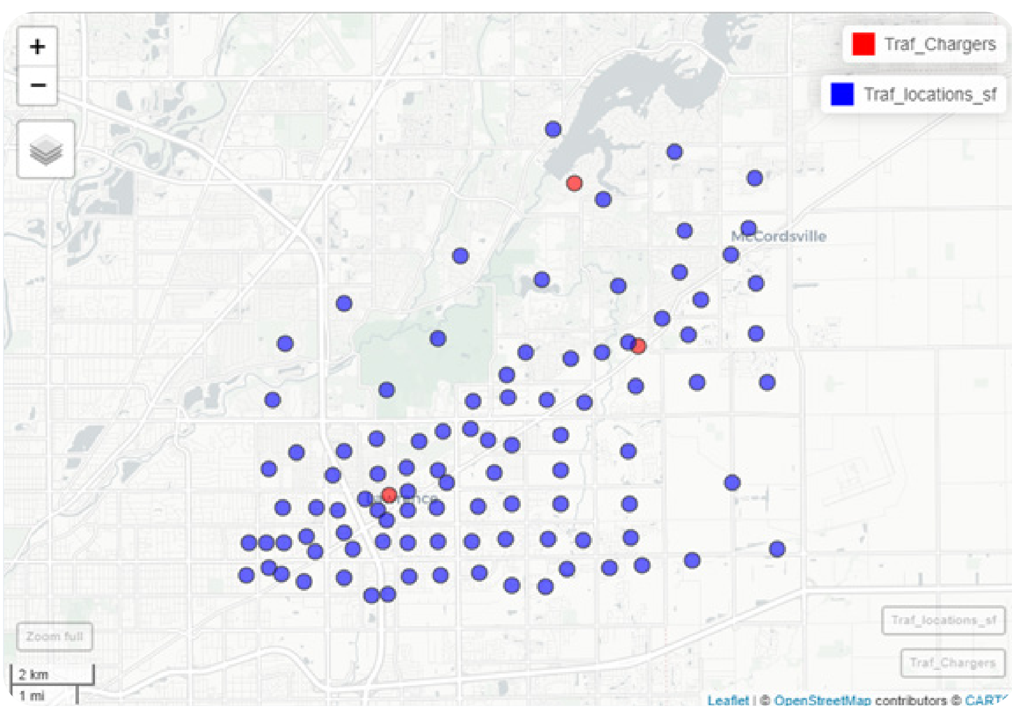

Figure A-5. Scenario 3 Traffic-Based Model Output

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Appendix B - Public Engagement

CONTENT TO BE ADDED FOLLOWING NOVEMBER OPEN HOUSE.

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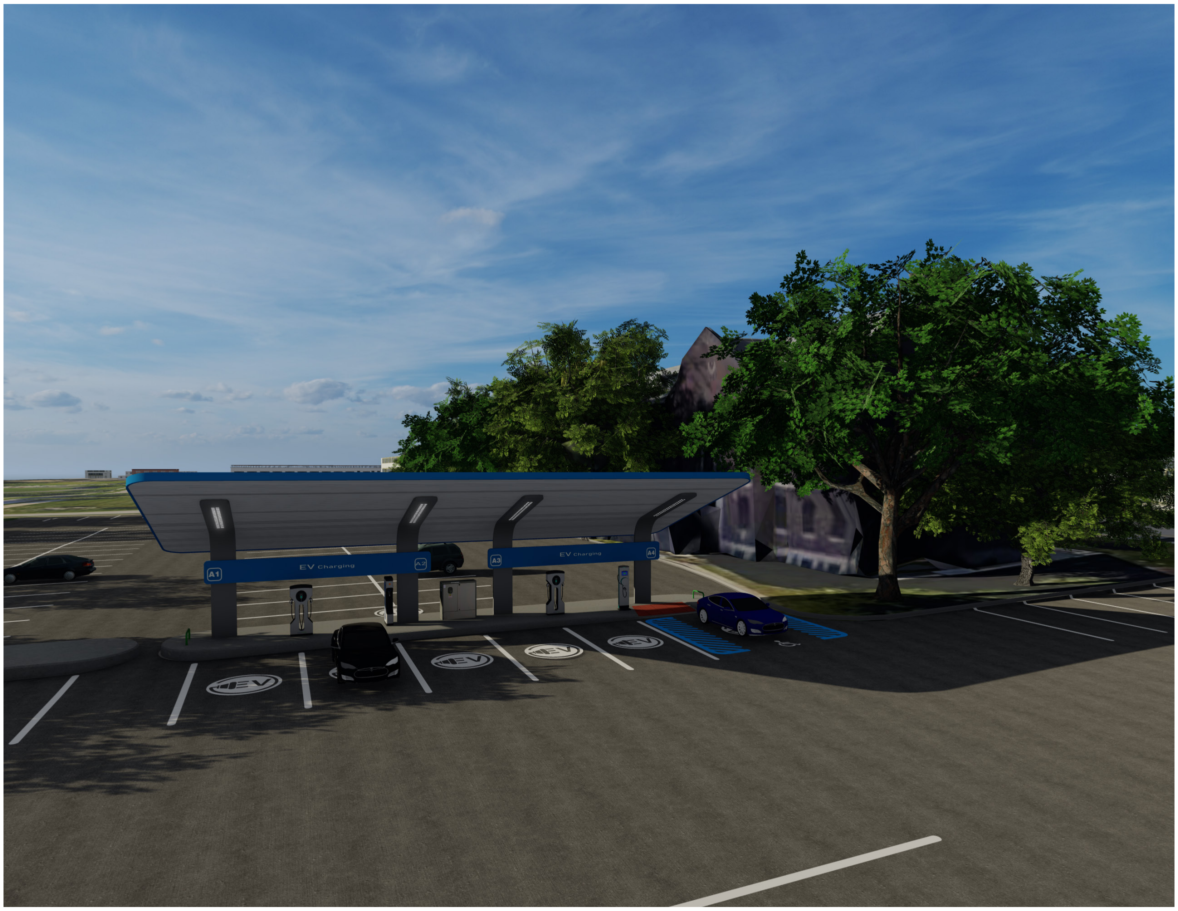
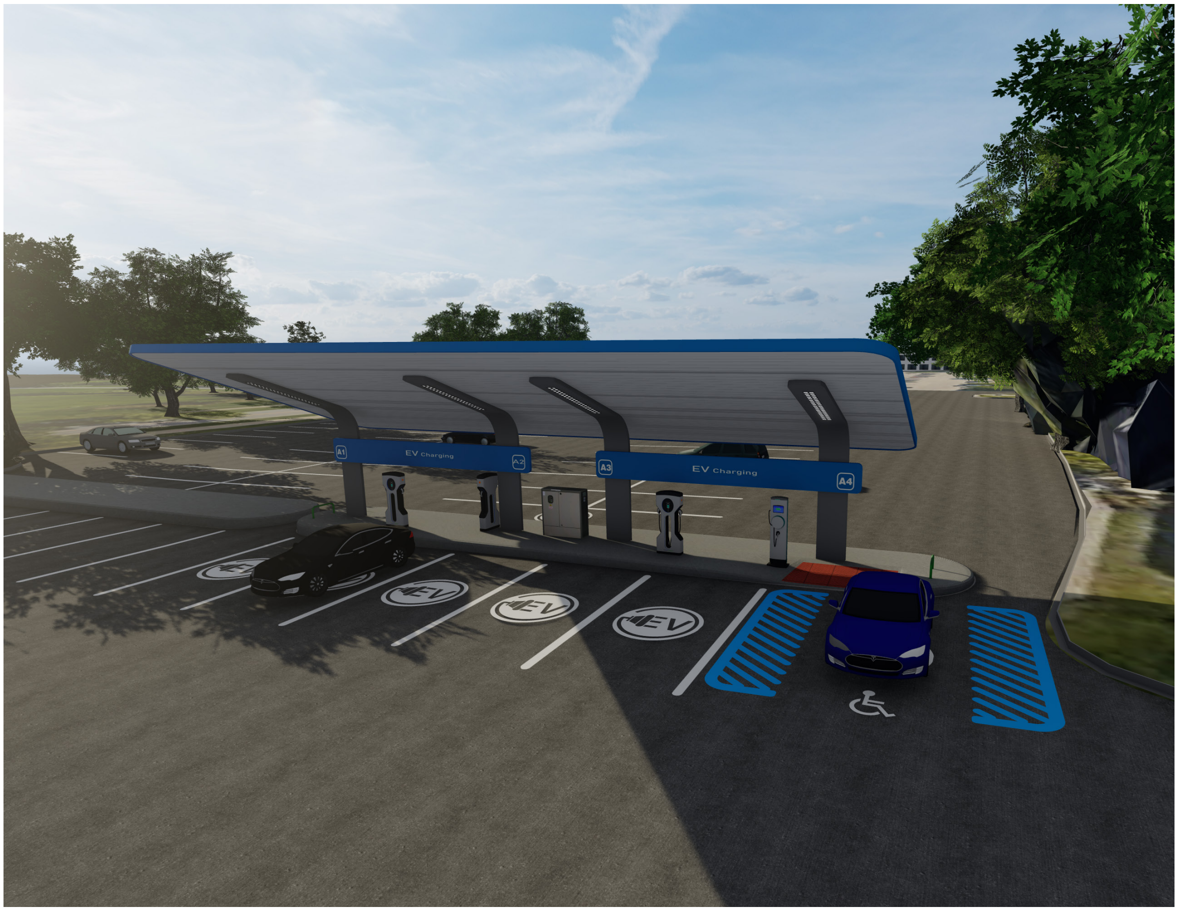
Appendix C - Additional Site Renderings

Government Center Site

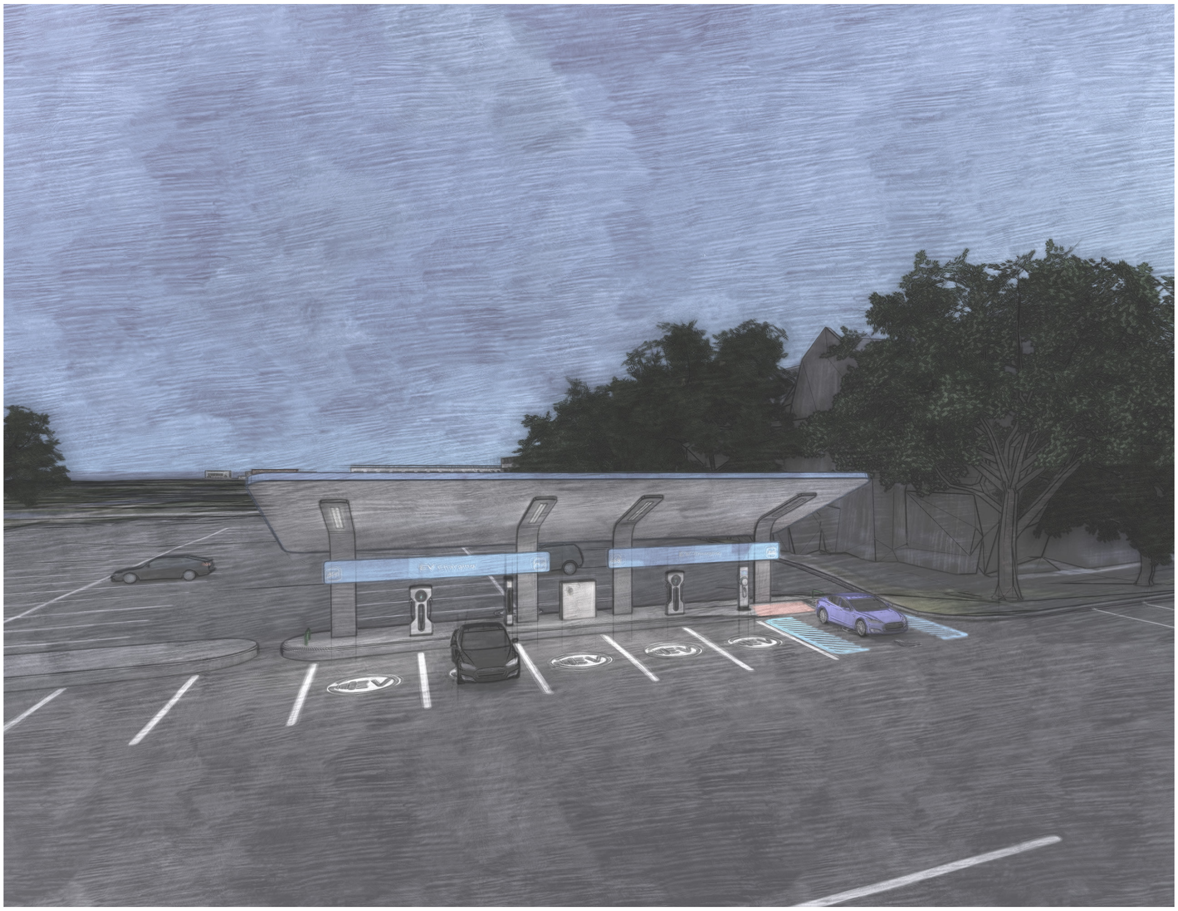



EV Charging
A3
EV Charging
A4

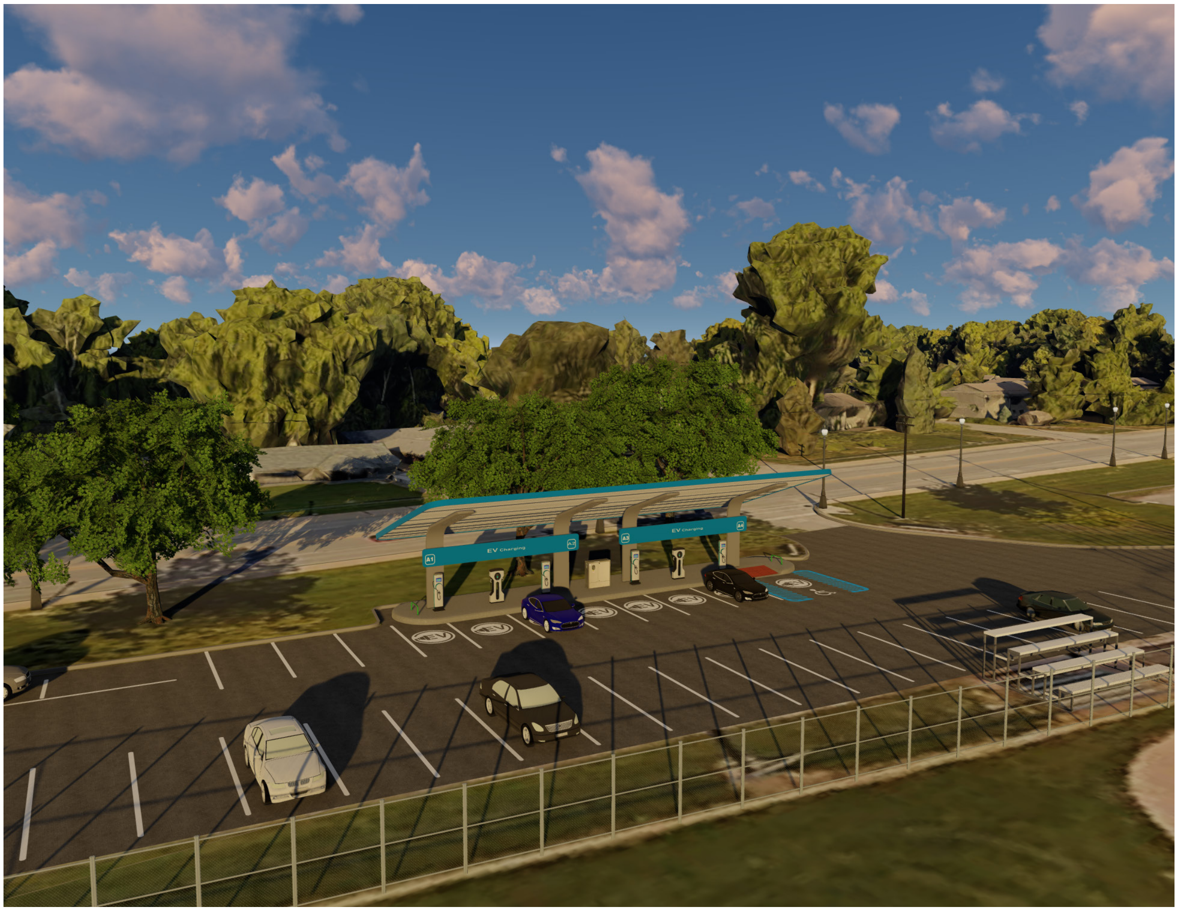

EV Charging
EV Charging
A4


A1
EV Charging


A1
EV Charging



Lawrence Community Park




EV Charging
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EV Charging
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