

# PREPARING FOR ELECTRIC VEHICLES: HOW MISSOURI COMMUNITIES CAN GET READY

by Luke Hagedorn

There is no doubt about it. Electric vehicles are on the way. In his 2011 State of the Union address, President Obama put forth a firm challenge for the U.S. automotive industry when he called for the United States to “become the first country to have a million electric vehicles on the road by 2015.”

Though President Obama’s goal of 1 million electric vehicles (EVs) by 2015 is probably overly optimistic, there are signs that the EV market in the United States is gaining momentum. In the span of one year, the market for EVs tripled from approximately 17,500 EVs sold in 2011, to approximately 53,000 new EVs in 2012. This growth is particularly impressive when you consider that the most mainstream EV offerings such as the Chevrolet Volt, Nissan Leaf, and Toyota Prius Plug-in Hybrid have often been available in limited quantities in major markets. Additionally, it is unlikely that the market penetration of EVs will continue to grow at a slow, incremental pace. Instead, it is likely that the number of EVs on the nation’s highways will increase dramatically as consumers become more exposed to EV technology and manufacturers release a broader selection of makes and models that appeal to a wider range of consumers.

Being the Show-Me State, it is perhaps unsurprising that many Missouri communities have delayed planning the local infrastructure and procedural processes that will be necessary to support widespread EV adoption. Fortunately, in 2011 the U.S. Department of Energy awarded a grant to the Metropolitan Energy Center in Kansas City, Mo., to produce a regional plan that can be implemented by municipalities in Kansas and Missouri to prepare public



resources and secure the economic and environmental benefits of EVs. This plan, that will be accessible at [www.electrifyheartland.org](http://www.electrifyheartland.org), compiles expert analysis from EV industry participants, local communities and public utilities. Subject matter experts such as Black & Veatch and the law firm of Polsinelli Shughart provide guidance to communities that are seeking to lay the foundation for widespread EV adoption.

Among the numerous findings detailed in the plan, Missouri communities should perhaps benefit the most from the discussion of the unique planning and regulatory efforts that will likely be required to accommodate EV adoption. While at face value, EV usage may not appear to require much attention, local governments should strongly consider taking the following steps before EVs start appearing on city streets:

- First, an estimate should be prepared of exactly how many EVs might be purchased in the community in order to get a sense of the scope and timing of the planning efforts that should be undertaken.
- Second, the municipality should examine its existing building codes to determine what standards should be applied to the installation of EV charging stations in residential and non-residential settings.
- Third, the municipality should examine its current electrical permitting and inspection process to determine how it will ensure that EV charging station installations are conducted in a safe and reliable manner, without unduly burdening either the installers or the permitting office.
- Finally, the municipality should examine its existing parking and signage ordinances to determine how it will treat parking spots with electrical vehicle charging stations.

## PROJECTIONS FOR MISSOURI EV ADOPTION

When talking about long-term national goals, it can be easy to lose perspective on local impacts. If the United States were to reach its goal of 1 million EVs on the road, how many EVs could be expected in the average community in Missouri?

	Traditional Vehicles	Electric Vehicles
Per Capita	0.8369	0.0034
Per 10,000	8,369	34
Per 100,000	83,692	342
Columbia, MO	92,428	378
Jefferson City, MO	36,265	148
Kansas City, MO	387,664	1,584
Springfield, MO	134,460	549
St. Louis, MO	266,199	1,088
State-Wide	5,029,047	20,545

Figure 1

Based upon motor vehicle registration data gathered by the U.S. Federal Highway Administration, Missouri had a total of just over 5 million vehicles registered in the state in 2011, or roughly eight vehicles for every 10 persons in the state. As Figure 1 below illustrates, assuming that the 1,000,000 nation-wide EVs are distributed proportionally with population among the states, Missouri could expect a total of just over 20,500 EVs, or about one EV for every 300 persons in the state. For a community of 10,000 people, this equals roughly 34 EVs, or roughly 340 EVs for a community of 100,000 (see Figure 1).

Of course, the real challenge for municipal governments lies not in the vehicles themselves, but with the infrastructure necessary to charge the vehicles, known as Electric Vehicle Supply Equipment (EVSE) or simply “charging stations.”

It is probably safe to assume that every person who purchases an EV also will purchase a charging station for their home so they will be able to charge their vehicles overnight. Additional charging stations will likely be installed by local businesses, by potential third-party suppliers of electricity, and by the municipalities themselves. Taking these additional charging stations into account, it can be estimated that roughly 1.5 charging stations will need to be permitted, installed and inspected for every EV located within a community. Figure 2 below extrapolates this estimate across the state to show the projected number of charging stations that will be required (see Figure 2).

### UPDATING BUILDING CODES TO ADDRESS CHARGING STATIONS

Once local planners have a sense of how many EVs can be expected in their jurisdiction, the question raised is what changes should be made in the local ordinances and policies to accommodate this influx of new vehicles and charging stations. Because there is no statewide authority for building codes in Missouri, it will be necessary for local communities to review their building codes to ensure that EV charging stations will be safely integrated into new and existing structures. As with any revisions of building codes, the main goal of the process is to incorporate as much flexibility as possible while maintaining the highest level of safety.

Specifically, there are a number of revisions that communities can make to their building codes that will significantly improve the processing time and effectiveness of their planning efforts for EV charging stations. A few are described below:

To ensure safe and up-to-date practices are utilized during installations, adopt the most current version of the National Electrical Code (NEC), or at least Article 625 of the NEC that includes best practices for wiring methods, equipment construction, control and protection, and equipment locations for EV charging stations.

Require all new, reconstruction and renovation building projects to ensure that the electrical room and all conduits leading to the electrical room in new multi-unit, commercial or industrial developments are appropriately sized to accommodate future electrical equipment necessary for charging stations, as well as the voltage and amperage capabilities of the accompanying infrastructure.

Require that all newly permitted construction or renovation projects install sufficient conduits, junction boxes, wall space, electrical panels and circuitry capacity in locations that could potentially serve EVSE sites in the future, such as garages and parking facilities.

### UPDATE ELECTRIC PERMITTING ORDINANCES TO ADDRESS CHARGING STATION INSTALLATIONS

For most municipalities across Missouri, the primary logistical hurdle for EV adoption is how to design a permitting and inspection process for EV charging stations that will allow for safe and reliable installations without unduly burdening the administrative staff. Currently, when faced with an electrical permit for the installation of an EV

charging station, most municipalities’ default position is to either follow the pre-established procedure for miscellaneous electrical permits or fail to permit the installations at all. Both scenarios present unsatisfactory results and fail to consider the particular complexities of installing an EV charger. This puts the public confidence in EVs and EVSE at risk unnecessarily.

When designing these inspection programs, one of the easiest ways to minimize the administrative burden while efficiently allocating resources is to recognize the fact that communities will face a wide spectrum of potential scenarios for charging station permits, and there is no single permitting process that would be appropriate for all occasions. For example, significantly less regulatory scrutiny will be needed for installation of a small charging system in a residence than would be required for a large commercial entity that wants to install numerous charging stations for use by customers and employees. As discussed more thoroughly below, in order to accommodate these different needs and allocate resources appropriately, many communities across the country are adopting a multi-tiered process that applies different levels of scrutiny to projects based upon the project’s complexity.

### SINGLE-FAMILY RESIDENTIAL INSTALLATIONS

By far the easiest EV charging alternative for most consumers is to utilize an existing 120-volt outlet located in the garage. Obviously, in these cases an electrical upgrade is not required, so no permit is needed. In cases where a dedicated 120V or 240V receptacle and circuit is desired for a charging station, a minor electrical permit likely needs to be issued, though it can easily be handled under the city’s existing permitting requirements.

**Figure 2: Projected Missouri Charging Stations (assuming 1 million EVs nationally)**

	Electric Vehicles	Charging Stations
Per Capita	0.0034	0.0051
Per 10,000	34	51
Per 100,000	342	513
Columbia, MO	378	567
Jefferson City, MO	148	222
Kansas City, MO	1,584	2,376
Springfield, MO	549	824
St. Louis, MO	1,088	1,632
State-Wide	20,545	30,818

However, in cases where the resident's existing electrical panel cannot safely meet the increased electricity needs, then an additional permit will be required in order to either upgrade the electrical panel or install a new panel and meter. In order to gather all of the information needed to properly assess the safety of the installation, many municipalities across the country are adopting a stand-alone permitting form for these installations. Often, these permits are based in large part upon a form permit application that has been prepared by the U.S. Department of Energy's Alternative Fuels and Advanced Vehicles Data Center, available at [http://www.afdc.energy.gov/pdfs/EV\\_charging\\_template.pdf](http://www.afdc.energy.gov/pdfs/EV_charging_template.pdf).

Beyond adopting a specialized stand-alone permit, there are other steps that a community can take to streamline the permitting process. For example, if the non-minor permit application has been submitted by a certified electrician that has received training in the installation of EV charging stations from a nationally-recognized training program, the local government can have some comfort that the installation is safe and therefore can adopt less stringent inspection processes, such as inspecting one out of 10 installations or foregoing inspections altogether. Where the installation was conducted by an electrician that has not been trained in EVSE, then many local governments have made it a priority to inspect the projects as soon as possible. For example, many municipalities across the country have committed to conducting inspections within 24 hours of the installation of the charging station equipment.

#### **LARGE SINGLE-FAMILY RESIDENTIAL, MULTI-FAMILY RESIDENTIAL AND COMMERCIAL INSTALLATIONS**

While small single-family residence installations likely present relatively few safety risks, charger installations in larger settings can be significantly more complex and thus require more oversight from local permitting bodies. As an example, compare the installation of a new 120V / 1.8 kilowatt outlet in a residential garage to the installation of 10 quick-charge stations outside of a movie theater or grocery store, each of which are capable of handling 240V and up to 20 kilowatts of electricity. For these more complex projects, communities should consider requiring applicants to fill-out a specialized permit and provide more scrutiny to these types of installations.



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#### **EV SIGNAGE AND PARKING MARKING PLANS**

Though we seldom stop and think about their impact, street signs can serve three important functions to facilitate the adoption of EVs in a community. First and most obviously, they can direct EV drivers to the nearest public charging stations. Second, they serve to educate non-EV drivers about the availability of charging stations, and thus promote confidence that, should they decide to purchase an EV, there will always be a charging station readily available. Finally, they can publicize premium reserved parking spots, should the government choose to utilize the parking locations as an incentive for EV drivers.

Given the potential importance of signage to the public's perception of EVs, it is perhaps not surprising that a significant amount of debate has occurred at the national level regarding the adoption of a uniform standard for EV charging station signs. Currently, roadway signage is regulated by the U.S. Department of Transportation, Federal Highway Administration (FHWA). Specifically, approved signage requirements are contained within the "Manual of Uniform Traffic Control Devices" (MUTCD).

In its current form, the MUTCD does not contain any requirements for EVSE signage. However, there is a process by which state transportation agencies may submit a request for so-



**Figure 3: FHWA-approved EV Signage**

called "experimental" signage. If approved, the experimental signs may be used within the state subject to certain requirements and restrictions. By way of example, in 2011, the Departments of Transportation for the States of Washington and Oregon submitted a request for the FHWA to consider an EV Charging General Service symbol, displayed as Figure 3 below. The FHWA granted those states an interim approval to use the signs to designate charging station locations.

In order to promote consistency, Missouri communities should seriously consider adopting this FHWA-approved signage, and encourage the Missouri Department of Transportation to submit a request and obtain approval from the FHWA to utilize the symbols in the state. These symbols have already been thoroughly evaluated by the FHWA and were found to be highly



visible and comprehensible by a large segment of the population. Additionally, adopting a symbol that is being utilized in other jurisdictions across the country increases the effectiveness of the symbols by promoting uniformity and recognizability.

While the FHWA approval process is being pursued, local communities also can begin to present this signage as an option for local businesses to utilize on private property, similar to what many businesses use currently for "Pregnant Mother" parking spaces. Of course, such signage would be unofficial and entirely without the force of law, but its adoption would signal that the business recognizes and supports the needs of its EV-driving clientele.

### INCENTIVES OR PENALTIES FOR EV CHARGING STATION PARKING

Finally, once the stations are installed and the signs are put up, public and private parking facility owners will need to determine whether, and to what extent, such signs will be enforced.

In Missouri, the enforcement of street signs on public property is currently a prerogative of local governments, and thus each community will need to determine the level of enforcement that is appropriate for its populace. However, when setting these enforcement policies, it is important that communities carefully weigh several competing interests. First, during the early years of EV adoption, parking spots with EV charging stations may be vacant for large periods of time. It is possible that a negative sentiment could develop if these spots are located in high-traffic areas and parking by non-EVs is prohibited and strictly enforced. On the other hand, the availability of these charging locations is critically important for fostering range confidence for EV drivers.

To successfully balance these concerns, local communities might consider promoting the placement of



EVSE in locations that are convenient and accessible, but not necessarily in the most desired or prominent parking locations. Additionally, if the community is considering adopting punitive actions for non-EVs parked in an EV spot, the community might consider foregoing enforcement of those penalties until the level of EV adoption in the community is strong enough to ensure that the spots are filled a significant amount of the time.

### PROPER PLANNING WILL LEAD TO A SMOOTH TRANSITION TO EVs

There is no doubt about it, EVs are on the way. By taking a few relatively

minor steps to prepare for this influx of new vehicles and the infrastructure needed to support those vehicles, local communities will be able to minimize logistical and administrative burdens and ensure that local residents across the state are able to enjoy their new vehicles safely. □

**Luke Hagedorn** is a regulatory and transactional attorney in the Energy Practice Group at Polsinelli Shughart. He represents a wide range of companies in the various energy industries, and recently served on the Steering Committee for Electrify Heartland, a DOE-funded planning project of the Metropolitan Energy Center tasked with evaluating the Kansas and Missouri region's readiness for electric vehicles and charging station infrastructure.

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voice:314 775 0092 fax:314 775 0094 mail@sullivanpublications.com