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Electric Vehicle Service Provider Networks and Market Distortions

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Abstract

The authors discuss the potential for market distortions in the market for plug-in electric vehicle (PEV) charging infrastructure. While existing market conditions give no indication that anti-competitive market distortions will emerge, the authors explore a worst-case future scenario where the emergence of regionally dominant firms pave the way for market distortions such as anti-competitive pricing, high switching costs, and access barriers. The authors first analyzed market developments in two regulated, more mature industries: automated teller machine (ATM) networks and mobile telephones. Anti-competitive pricing could take the form of high foreign fees for non-member transactions on electric vehicle service provider (EVSP) networks, or monopoly pricing to members. High EVSP network switching costs for PEV charging infrastructure owners and members could reinforce the regionally dominant firm's position. Access barriers, primarily a lack of information about PEV charging infrastructure, could lead to suboptimal PEV infrastructure utilization, harming site hosts, owners, and consumers. Inter-network transactions, a potential competitive response by non-dominant EVSP networks, gives rise to a new set of considerations. The authors conclude with contract and policy recommendations for local governments, site hosts, and PEV charging infrastructure owners to mitigate the risk of future market distortions.

Keywords: electric vehicles, charging infrastructure, markets, policy

1 Introduction

Increasing interest in plug-in electric vehicles (PEVs) in the United States has left many questioning the role of cities and regions in supporting the PEV market and developing a publicly-accessible PEV charging infrastructure. Cities and regions have a range of policy options at their disposal. Some have pursued a hands-off approach that transfers the responsibility of developing a publicly-accessible charging infrastructure to private actors. Others are pursuing mixed approaches where both the public and private sectors are active in the provision of infrastructure. Irrespective of the approach employed, cities and regions must determine their goals and objectives when addressing PEV infrastructure.

This paper focuses on how cities and regions can develop or support the development of economically efficient, publicly-accessible PEV charging station infrastructure by minimizing potential market distortions. Residential charging is expected to be the primary means by which most drivers will recharge their PEV batteries. However, workplace, commercial, and public locations will serve as secondary charging opportunities, and as primary locations for those without regular access to charging at their residence.

Early decisions affecting drivers and charging station site-hosts have implications that could support or undermine the success of the PEV market. This paper analyzes how the public sector can address three anticipated potential market distortions: (1) anti-competitive pricing for accessing out-of-network charging stations; (2) high switching costs for charging station owners wanting to switch between electric vehicle service provider (EVSP) networks; and (3) barriers to drivers attempting to locate and access charging stations.

Possible outcomes of market distortions include the suboptimal allocation of publicly-accessible charging stations, low charging station utilization rates, the inability for some drivers to access charging in lifeline situations, and, more generally, a charging station infrastructure that does not support a positive PEV driving experience.

2 ATMs and Charging Stations

Early market issues for Automated Teller Machines (ATMs) are similar to those currently facing publicly-accessible charging stations. The evolution of the ATM market provides insights for the future of charging station infrastructure.

2.1 The Emergence of ATMs

ATMs started as alternatives to tellers that offered the bank a lower cost per transaction and offered customers 24 hour access. At the dawn of ATMs, virtually all of the machines were located at existing bank branches [1].

In the early 1970s, banks were faced with two expansion options: build new branches or new ATMs. Building new branches would cost around $1 Million for construction and $500,000 per year to operate. ATMs not located at bank branches would cost about $100,000 to establish and $50,000 per year to operate [2]. Given that an ATM's capital and operating costs were 90 percent less than a branch's, many banks chose to install ATMs.

In the late 1970s and early 1980s, banks began to form regional ATM networks for a variety of reasons. First, banks sought to increase ATM utilization rates to amortize capital and network costs over more customers and transactions [3]. Secondly, smaller banks sought to share ATM access with other banks in order to compete with larger banks, which were able to offer more ATM locations -a valued customer convenience. Interbank networks – shared ATM networks dedicated to authorizing and clearing transactions across multiple banks – emerged in response to high demand from smaller banks. Customers could complete transactions at any ATM or point-of-sale device which belonged to the interbank network.

Competitive forces significantly influenced the evolution of ATM networks. Baker noted that banks participated in ATM networks because of the competitive advantage it allowed, and because of the fear of being left behind in the marketplace [4]. Baker adds that an aggressive, growing bank wanted to provide value-added services at the ATM above and beyond their competitors who would value a least-common denominator network that would level the playing field.

In regions where two or more ATM networks emerged, networks would compete to attract new banks, which resulted in lower fees [5].

The potential for anti-competitive market manipulation became a concern in the 1990s, as regional ATM networks looked to consolidate. Consolidation led the United States Federal Reserve Bank to review all ATM network mergers and acquisitions. In reviewing the 1994 merger of NYCE and Yankee 24, The Federal Reserve Board of Governors was particularly interested in how networks treated card issuer routing instructions, which would permit card-issuing banks to route transactions via lower cost networks if the combined NYCE and Yankee 24 network attempted to raise prices [6].

Baker writes that "serious antitrust concerns are raised if a monopoly network—or even a very strong one—insists that all transactions be routed by it wherever possible. This makes the creation of a new network competitor very difficult indeed and should probably be illegal on a tie-in or boycott theory." The United States Department of Justice ordered monopoly routing rules eliminated in its EPS/National City consent decree.

This example underscores how anticipating anti-competitive practices can protect consumers, while allowing market participants to earn a fair return on their investment. Today's nascent EVSP networks are facing similar issues.

2.2 EVSP Networks

Electric Vehicle Service Providers (EVSPs) can offer a variety of services in the PEV charging infrastructure value chain. Charging station equipment procurement, installation, ownership and management, and information and management gateway services are among the most common services provided by EVSPs. An example EVSP is NRG EV Services, LLC, or eVgo as it is more commonly known. eVgo offers a suite of charging station products to commercial and residential consumers, provides installation services, owns and manages publicly-accessible charging stations, and provides an information and management gateway [7].

We see two reasons for the emergence of EVSPs. First, United States Department of Energy programs have subsidized many early-stage firms, allowing them to bridge the gap between investment and revenues, and deploy charging stations to support the early PEV market. ChargePoint America (managed by Coulomb Technologies, Inc.) and The EV Project (managed by ECOtality, Inc.) offer subsidized charging stations.

Secondly, firms wishing to deploy charging stations face a steep learning curve. The installation process is complex and often requires an informed manager to proceed. EVSPs possess specific knowledge about installations and thus have lower learning costs for each installation. Site hosts or charging station owners might contract with EVSPs because of barriers to understanding and managing the process, which includes elements of permitting, electrical contracting, marketing (publicizing charging station availability), and management.

We define an EVSP network as any number of charging stations linked to a proprietary information and management gateway that manages access policies on behalf of the site host and, or, charging station owner. Most networks allow charging station owners to define specific access policies, such as variable hourly prices, as well as offering charging station marketing services through websites, mobile phone applications and in-vehicle information and navigation systems. Blink Network, ChargePoint Network and SemaCharge are examples of information and management gateways that are owned by EVSPs.

In pursuit of market dominance, EVSP networks have created subscriber services and have vertically integrated and branded charging stations with network services, much like the mobile phone market in the United States. In an effort to "de-commoditize" PEV charging, many EVSP networks are attempting to distinguish themselves in the marketplace by offering drivers attractive subscription packages, similar to banks wanting to offer additional value-added services at ATMs in an effort to distinguish themselves from ubiquitous cash machines. For example, the Blink Network is integrating digital advertising on its publicly-accessible charging stations to generate additional revenue and enhance visibility.

3 Anticipating Market Distortions

We discuss in detail three market distortions that cities and regions should be cognizant of when considering public policies and charging station technology choices within their jurisdiction: (1) anti-competitive pricing; (2) switching costs; and (3) barriers to access.

Market distortions for publicly-accessible PEV charging infrastructure will be strongly influenced by two possible market developments: (1) the emergence of a dominant regional EVSP firm; and (2) the creation of inter-network transactions. These conditions are not required for market distortions to develop, but we discuss their influence in our analysis.

One goal of EVSP networks is to capture regional market share. An EVSP network's value to the consumer is a function of location coverage, availability, price, and additional services. The value to a charging station owner or site host is in utilization and ancillary benefits, which improves their return on investment (ROI).

This creates a self-reinforcing loop that can lead to the emergence of a dominant regional EVSP firm. For example, if the ChargePoint Network has the most members in a region, site hosts and owners would prefer to be on the ChargePoint Network since it would likely improve ROI. As a result, more PEV drivers may choose to join the ChargePoint Network.

A likely competitive response by EVSP networks which do not emerge as the dominant firm in a regional market would be to pursue inter-network transaction agreements, much as smaller banks sought to create regional interbank networks to process ATM transactions.

3.1 Anti-Competitive Pricing

One potential market distortion that could hurt the PEV market is high prices charged by a regional dominant firm. Higher prices for accessing charging stations could undermine consumer interest in PEVs as it makes operating a PEV less economical, and therefore, less competitive compared to vehicles using other fuels, including gasoline. With range anxiety a significant concern for many early market consumers, being able to access publicly-accessible charging stations at a reasonable cost will be important; high access prices could deter prospective drivers. Furthermore, the dominant firm is abusing its market power by charging high foreign fees, which forces drivers to become network members, thereby increasing customer loyalty, and further reducing market competition.

One means of encouraging network membership is by charging non-members a fee for accessing the charging station. Banks charge foreign fees when their proprietary bank card is used at an unaffiliated bank's ATM in order to encourage use of their own ATMs, or to entice non-bank members to join the bank (in order to avoid incurring foreign fees). While this practice is common and not necessarily anti-competitive in a mature market, we argue that it could contribute to a negative driving experience in the early market for PEVs, depending on the amount of the fee.

Several different business models have emerged, each with different pricing strategies for members and non-members. Keitel notes three models for smart cards and payment systems: proprietary closed-loop, shared-card, and open acceptance [8]. Under a proprietary closed-loop model, consumers can only use a proprietary card issued by an EVSP network. Customers must maintain accounts with EVSP networks and fund those accounts via cash, check, credit, or debit, but cannot use these payment methods at the point of sale (e.g., the charging station). Under a shared-card model, cards are co-branded with a bank and EVSP network's logo and function as a credit or debit card in addition to a charging station access card. The co-branded bank account can be linked with the EVSP network account in order to cover EVSP network transactions. Under an open acceptance model, customers can use bank-issued credit, debit, and prepaid cards to access charging stations. The customer is not required to have an EVSP network account.

The Blink Network offers three membership packages that approximately parallel the three smart card payment systems discussed. Blink Plus, Blink Basic and Blink Guest offer three ways of accessing the Blink Network. Blink Plus requires an annual membership fee ($30.00) and offers hourly charging prices "as low as $1.00 per hour" [9]. The Plus package requires a proprietary card and is similar to the closed-loop model. The Basic package offers hourly charging "as low as $1.50 per hour" and does not require an annual membership fee. However, a proprietary card must be used and a credit card linked to the Blink account. This Basic package is another version of the closed-loop model, but without the annual membership fee. The Guest package offers hourly charging "as low as $2.00 per hour," does not require membership fees, does not require a linked credit card, and does not use a proprietary access card. Instead, users pay via mobile phone. The Guest package is most similar to the open acceptance model.

Comparing the Guest and Basic package access prices, the Blink Network is charging a $0.50 foreign fee to non-members, meaning that if a vehicle were plugged in at a Blink charging station for 2 hours, members would pay $3.00 and non-members would pay $4.00. Given the relatively small dollar amounts, the 33-1/3 percent price increase seems reasonable, but one could foresee situations where unreasonably high access prices charged to non-network members would either discourage public charging, or force drivers to become network members.

Charging infrastructure is currently being developed relatively unevenly in many cities, usually characterized by the presence of one dominant EVSP network. For example, the Blink Network is dominant in San Diego, California with approximately 44 publicly-accessible charging stations (as of February 2012) in the metropolitan area, whereas the primary competing network, The ChargePoint Network, has only 5 publicly-accessible charging stations – nearly 9 times fewer. It is likely too early to determine if the Blink Network's potential to emerge as a regional leader in the San Diego market would be characteristic of a monopoly, or a dominant firm oligopoly model, but some of the ingredients that existed for potential market manipulation by ATM networks in the early 1990s are present.

Assuming dominant firm oligopolistic competition with one dominant EVSP network firm with the largest regional market share and several EVSP network firms with smaller market share, the dominant firm is in a position to price charging station access in a way that forces drivers to either become a member of the dominant firm's network, or it discourages them from utilizing publicly-accessible charging. The Blink Network has published a 33-1/3 percent foreign fee for non-members, but a lack of competition could allow it to charge a 200 percent foreign fee, which would raise the price from $1.50 per hour to $3.00 per hour. In the short-run, non-member consumers would feel price gouged. In the long-run, they would likely respond by joining the Blink Network, increasing its market power in the region relative to the competition. The EVSP could use this market power to increase rates to members.

3.2 Switching Costs

In a more mature market, charging station operators and customers will have more information available to make decisions regarding EVSP networks membership. However, in the early market where EVSP networks are still developing new services, new networks are emerging, and public charging behavior is not well understood, site hosts and consumers require the flexibility to switch between EVSP networks with relatively low costs in order to effectively support public PEV charging needs.

Switching can occur for a variety of reasons. A rational consumer who finds that their EVSP network lacks convenient locations or charges a high price relative to another network will seek to switch networks. A PEV charging infrastructure owner may find that switching networks will increase their revenue. A site host may find that another network would produce higher utilization rates and ancillary benefits.

Switching costs are familiar to mobile phone owners, many of whom sign 1 or 2-year contracts with cellular network providers. The most prevalent, and often the largest, switching cost is the early contract termination fee, but other costs, such as payment for mobile phone modifications to enable compatibility with other networks, are also common.

Complicating network switching is the increasingly common practice of EVSPs vertically integrating network access with charging stations. EVSPs like ECOtality, Inc. and Coulomb Technologies, Inc. are bundling access to their respective networks (Blink Network and ChargePoint Network) with their charging station products. Vertical integration of this kind raises concerns about the ease of network switching, especially considering charging station unit and installation costs.

Similar vertical integration is common in the United States cellular communications market where cellular network service providers like Verizon Wireless, AT&T and Sprint bundle network access with network-branded mobile phones, and restrict the compatibility of phones with other networks. Arguably, the most well-known example was Apple Inc.'s iPhone which had a network exclusivity agreement with AT&T in the United States when it was first released in 2007. The iPhone had a SIM (subscriber identity module) lock, which prevented users from replacing the SIM card for use on other GSM (global system for mobile communications – a cellular network standard that uses SIM cards) networks, thereby further restricting the phone's use to a single network (users could illegally unlock the phone, thereby rendering it compatible with virtually any GSM network).

In the years that followed the iPhone's release, customers repeatedly expressed frustration with AT&T's service quality, and equal frustration with the inability to use the phone on other networks. What resulted was customer dissatisfaction with AT&T and Apple because of AT&T's monopoly over iPhone network access. Users had to wait until 2011 for the iPhone to be available with multiple networks, such as Verizon Wireless and Sprint.

Internal and external costs are present with high network switching costs, for both cellular networks and EVSP networks. The high switching costs imposed by Apple and AT&T were not only borne by the phone's owner or user, but also by parties trying to communicate with the iPhone user. For example, a lost cellular signal resulting in a dropped call increases the costs of transmitting information to both parties involved in the transaction – both parties are frustrated that they have to consume additional time to continue the call and pick up where they left off. The high switching cost facing the iPhone customer results in two costly possibilities: (1) continued use of the iPhone with AT&T's unsatisfactory service, or (2) buying a second mobile phone for use on a second network (we assume having a mobile phone is not an option in the 21st century).

A similar situation could arise with vertically integrated EVSP networks. The information and management gateway alerts PEV drivers to charging opportunities – a critical marketing function for charging station owners, operators, and site hosts. Effective marketing enables the pursuit of revenue or utilization maximization strategies affecting the profitability of providing PEV charging. For example, commercial site hosts offering unlimited PEV charging will want to advertise this to PEV drivers to attract them to their place of business, where they will hopefully make purchases that will improve the ROI for charging stations.

Should a competing EVSP network provide a better marketing opportunity, the site host or charging station owner will want to advertise on that network, and possibly unsubscribe from the less-effective network. High switching costs, and the costs borne by subscribing to a network with low benefits, are internal costs borne by the charging station owner, operator, or site host. However, there are also external costs borne by the drivers who are unable to discover charging opportunities. Ineffectively marketed charging opportunities can lead to sub-optimal trip-making and refueling that can increase the total cost of PEV ownership. For example, if a driver can only locate a charging opportunity 5 miles away and is unaware of a charging opportunity 2 miles away, the driver bears additional time and energy costs for the extra 3 miles.

When a PEV charging station is underutilized, switching networks or joining multiple networks is an attractive option relative to buying and installing another charging station that is compatible with another EVSP network or purchasing additional charging station navigation services. Installation of additional PEV charging stations can be significantly costlier than previous installations for site hosts whose current electrical infrastructure is at capacity.

Several solutions could emerge to address the issue of high network switching costs. An increasing number of charging stations are sold unbundled from an EVSP network, much like the iPhone can be bought from Apple without a cellular network affiliation. Many of these charging stations can be installed with nearly any kind of communications technology – hardware or software – to enable cellular or wireless communications. An example is Aerovironment, Inc.'s EVSE-CS commercial charging station, which can be equipped with point of sale, and wireless and cellular communications compatibility. At the time of writing, only the ChargePoint Network provides compatibility with non-Coulomb Technologies charging stations through its OnRamp Program, however other EVSP networks might offer similar services in the future. This resolves the issue of vertically-integrated charging stations, however questions remain about how the charging station's physical exterior will be branded to reflect EVSP network affiliation in order to make it identifiable to drivers.

Much of the discussion in this section assumes the charging station will only be on one network, but a charging station owner, operator or site host may wish to place it on multiple networks. Currently all Chargepoint America Project and EV Project contracts forbid the site host from tampering with the vertically integrated charging stations, but can an independently owned charging station (i.e., non-vertically integrated, or associated, with an EVSP network) be part of multiple networks? This is still a grey area since this problem has yet to emerge.

Multiple network connectivity in one charging station could improve the charging station's marketability. For example, many third-party (non-bank) ATMs provide multiple network access for processing and clearing transactions in order to be accessible to a broad customer base, as opposed to being on a single network, which would minimize the customer base. The emergence of multiple-network PEV infrastructure, similar to third-party ATMs, would likely lead to an ATM-like pricing structure. While existing EVSP networks currently charge a foreign fee for non-member transactions, three new fees could emerge. These include (1) a surcharge by the PEV charging infrastructure owner (currently captured in total price paid); (2) a fee that the consumer's EVSP network pays the PEV charging infrastructure owner; and (3) a switch fee charged by the EVSP network to process transactions. One take-away from ATM networks is that when both the charging station infrastructure and access cards are on multiple networks, the routing preferences of the access card should trump those of the charging infrastructure in order to avoid high switch fees.

Non-EVSP network marketing is a third way of avoiding high switching costs associated with vertically integrated charging stations, and could be a legally acceptable means to advertise through additional platforms. Websites could advertise similar information being shown to EVSP network subscribers about charging station access (hours of operation, price, accepted payment methods, etc.), but without real-time information like availability status and reservation capabilities. This wouldn't be as effective as real-time information provided through the EVSP network site, but could be *good enough* for charging station owners, operators or site hosts who do not perceive any additional benefit from subscribing to a network. Some third-party websites, such as Recargo, combine static and real time data to provide drivers with a possibly more comprehensive set of charging possibilities. For example, Recargo is one of the first websites to integrate the ChargePoint Network API (application programming interface – allows Recargo to automate data transfers from the ChargePoint Network), thereby performing a data aggregation role for customers. If multiple EVSP networks shared their information with third-party websites like Recargo, drivers would be able to use these sites as dashboards for better trip and refueling planning.

As the U.S. Department of Energy pilot projects (ChargePoint America Project and The EV Project) reach full-term in 2013, and ownership transfers from the project administrator to the site hosts, vertical integration, early contract termination fees, and other switching costs will become real issues for many charging station owners.

The Department of Energy pilot programs selected EVSPs offering bundled network and charging station services. The Chargepoint America Project and The EV Project have customized contracts requiring site hosts to remain network members for the duration of the pilot project for data collection purposes. Upon contract termination in 2013 – the year the pilot project ends – full station ownership transfers to the site host. For the duration of the pilot project period site hosts can terminate their contracts relatively easily.

The largest foreseeable problem will be to continue to include contract language forbidding any modification to the charging station. The price of a publicly-accessible charging station ranges from approximately $1,000 to over $5,000 for Level 2 units (220 Volts), and more than $10,000 for DC Fast Chargers. Given the high cost of the units, site hosts will be reluctant to replace their charging stations at a rate that exceeds its useful life (or asset class depreciation schedule). Therefore, it will be important to provide owners, operators and site hosts the flexibility to remove or install hardware and software allowing charging stations to be on EVSP networks other than the one it was originally designed to be for. A complication arises when the unit's exterior is branded with logos from another network (which is one reason why the contracts restrict the charging stations from being on other networks in the first place). With the Department of Energy subsidizing two vertically integrated EVSPs, it has created a market where these dominant firms could write contracts restricting network membership to a single network, much like the iPhone was restricted to AT&T.

3.3 Barriers to Access

Drivers' ability to locate all publicly-accessible charging stations is essential to limiting range anxiety, and accurately representing all charging opportunities. Being able to efficiently locate charging stations that satisfy driver criteria minimizes the transaction costs associated with PEV refueling. In the past, drivers located gasoline service stations haphazardly, by recommendation, or by looking at a map. Unless provided by a service station, maps did not discriminate among service station firms (e.g., Shell and Chevron). Today, in-vehicle navigation systems are able to direct drivers to the closest service station, and in some cases differentiate them by driver preferences, such as price and firm (e.g., Chevron stations offering gasoline at less than $4.25 per gallon). This technological advance has significantly reduced the costs associated with locating service stations, especially in unfamiliar geographic areas. This need is especially acute among PEV drivers since charging stations are typically not as visible as brightly-colored gasoline service stations located on street corners.

In the United States, the Department of Energy Alternative Fuels and Advanced Vehicles Data Center attempts to provide a comprehensive listing of all charging stations, yet the web-based user interface is not practical for drivers – even those using a smart phone – and it does not provide any price or real-time use information (e.g., occupied or unoccupied). Several websites display the static Department of Energy data by displaying them on a more user-friendly web-based map, but this is a far cry from integrating real-time charging station data with in-vehicle navigation systems and mobile phone applications.

A dichotomous publicly-accessible charging station infrastructure could emerge in the near future: charging stations marketed through an information and management gateway and those that are not. Among charging stations marketed through an information and management gateway, charging station information could be segregated by EVSP network. For example, at the time of writing no third-party navigation service in the United States, such as TomTom International BV, integrated more than one EVSP network. TomTom has integrated the ChargePoint Network, but has not released any plans to integrate other EVSP networks, such as the Blink Network. Granted, we are still in the early market stages, but from a driver's perspective this is akin to only being able to locate Chevron service stations, when Shell and Exxon Mobil stations are also available.

Publicly-accessible charging stations unaffiliated with an EVSP network might not be captured in the Department of Energy database, and will certainly not be displayed in in-vehicle navigation systems unless alternative marketing platforms are integrated. For example, Xatori Inc.'s web application, PlugShare, allows charging station owners and site hosts to conveniently add their charging station to a map at no cost to users by filling out a form asking for location, a telephone number, connector type and voltage level, address, and any comments.

Reducing costs to drivers associated with locating charging stations can support PEV market growth by visibly demonstrating all charging opportunities, which in turn reduces range anxiety and supports opportunity charging. Aggregation of charging information from different sources (e.g., Department of Energy, EVSP networks, crowd-sourced websites, etc.), and the ability to efficiently search through the data will be increasingly important as the market grows. Furthermore, the ability for drivers to identify charging stations according to specific preference criteria, such as access price, parking time, availability, and other variables, will improve trip efficiency and minimize searching for available charging stations.

4 Conclusion

We are not suggesting that EVSP networks with dominant market positions will engage in anti-competitive behavior. Our intent is to alert public decision-makers to the possibility of pricing policies that could create an inefficient publicly-accessible PEV charging market. Certainly, PEV market growth is in the best interests of EVSP networks as it will improve the total market available to their business. However, EVSP networks also seek ROI, and these objectives may conflict in the future, especially as subsidies wane.

At some point, a PEV charging infrastructure site host or owner may wish to swap out infrastructure, change EVSP networks, or advertise outside of a network. While multi-year contract terms might be necessary for an EVSP network to recoup its investment in a specific PEV charging infrastructure installation, site hosts and owners should be aware of the rules and fees governing the termination of an agreement with an EVSP or equipment owner, including the decommissioning or removal of equipment. In some cases, the contract may require indefinite or lengthy provision of electrical service to an unwanted PEV charging unit. Maintaining this service may preclude the utilization of existing infrastructure and necessitate the installation of additional units and costly supporting electrical infrastructure.

Site hosts and owners should be wary of contracts that restrict them from making information available to third parties such as navigation services, web sites, and app providers. Static information such as location, access rules, and price range should be available, at a minimum. Real-time information such as status, availability, and variable pricing is also valuable.

Unless a local government can include specific risk mitigation measures in a contract, it should avoid granting an EVSP exclusive rights to a public facility, or publicly-owned property at any geographic scale. Such an agreement could lead to a single EVSP becoming the dominant firm in a micro-market. Local governments can mitigate risk by sunsetting exclusivity periods, including termination clauses in the event that the EVSP engages in pricing seen to be anticompetitive, requiring the EVSP to make real-time unit information available to third parties, and requiring open access with a cap on foreign fees.

Smart contracting and awareness of potential market distortions can help ensure that the early PEV market develops with as few bumps in the road as possible.

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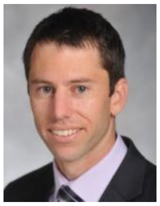

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