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Outcomes Report: Midwestern Dialogue on EV Infrastructure

Convening on Pathways to EVs in the Midwest

CITY OF COLUMBIA, MO

April 17-18, 2018

Prepared for:

Urban Sustainability Directors Network, City of Columbia, Missouri, and Participating Communities

Prepared by:
Chad Laurent, Cadmus
Cian Fields, Cadmus

CADMUS

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Discussion Summary

The following report summarizes the discussion from the two-day Convening on Pathways to EVs in the Midwest in Columbia, MO, on April 17-18, 2018. For further details on the structure of the workshop, please see the agenda in the Appendix of this document. The Convening included a mix of plenary and breakout group sessions, focused on topics covering context and trends for EVs in the Midwest, EV planning strategies and challenges, and in-depth focus groups evaluating a draft version of the Pathways to EV report guidance document.

Attendees

1. City of Branson, MO
2. City of Columbia, MO
3. City of Dubuque, IA
4. City of Evanston, IL
5. City of Iowa City, IA
6. City of Kansas City, MO
7. City of Lincoln, NE
8. City of Springfield, MO
9. City of St. Louis, MO
10. City of Columbia Water and Light
11. Ameren Corporation
12. Commonwealth Edison Company
13. Kansas City Power and Light
14. Clean Cities Coalition
15. Cadmus

Introductions and Opening Questions

Workshop participants began by introducing themselves and highlighting the steps that their cities and utilities had taken to deploy EVs. Common steps for cities included deploying EVs in municipal fleets for light duty vehicles (LDVs), buses, and installing various types of charging stations at city buildings and corridors. Utility representatives highlighted their steps to integrate EVs and their general outlook on EV deployment, which included ongoing pilot programs, general commitments to ensuring equitable access to EVs, further integration of the use of EVs in utility operations and addressing the technical challenges for scaling electric vehicle service equipment (EVSE).

Finally, the participants asked initial broad questions that bear on their decision-making and would help frame subsequent discussion. These questions included:

- How can cities further develop fast charging EVSE in high transit corridors?
- How can a region encourage standardization in terms of codes, regulation, and installation?
- How do cities ensure that EV policies equitably serve disadvantaged communities?
- How does the presence of a college community impact the development of EVSE?
- How can cities work with the private sector to incentivize EVSE?
- Which entities should own the infrastructure for EVs?
- How will the development of autonomous vehicles (AVs) affect EVSE infrastructure?
- What are the implications of ride-sharing trends for the future of EVs?
- Could there be a designation program for the best practices of cities related to EVs and EVSE, like the Department of Energy's (DOE) "Sol Smart" program for solar installations?

Private and Public Trends in EV Deployment

Following initial discussion, Cadmus, presented on the broader context surrounding the growth in EVs. This included a short history of the first efforts towards a modern EV in General Motor's (GM's) EV1 and its subsequent decline. In stark contrast with these fledgling initial efforts, the past five years have exhibited rapid growth in the EV industry. In terms of commitments from major private and public-sector entities, this includes:

- Commitments by automakers of $90 billion to develop electrified versions of many or all their car models, and in some cases, eliminate gas and diesel models entirely;
- Commitments by major nations to enact bans on sales of gas and diesel cars;
- Commitments by U.S. states to reach EV deployment goals;
- Commitments by major cities to ban the use of diesel vehicles;
- Commitments by 71 U.S. cities to secure 100% clean energy, with significant implications for the transportation sector.

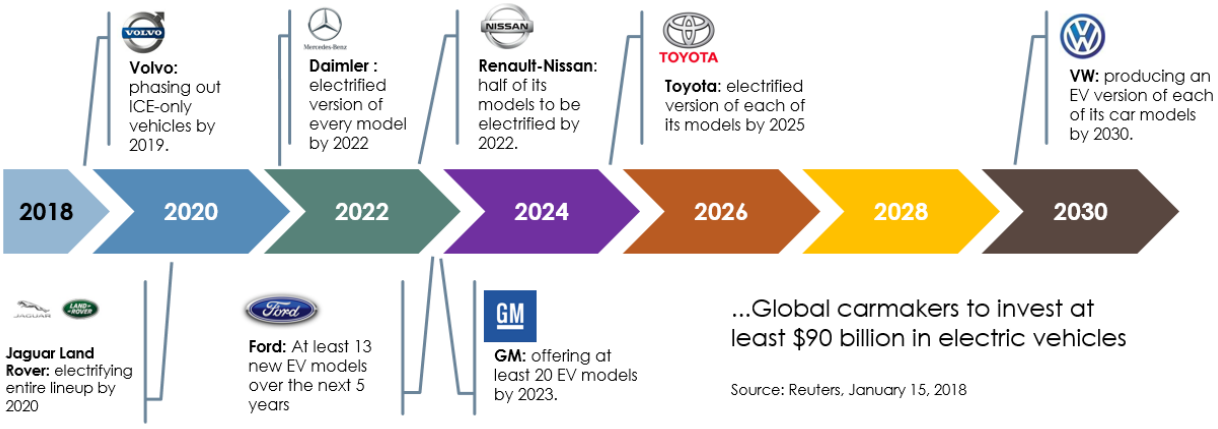

Figure 1. Sample of Automaker Commitments

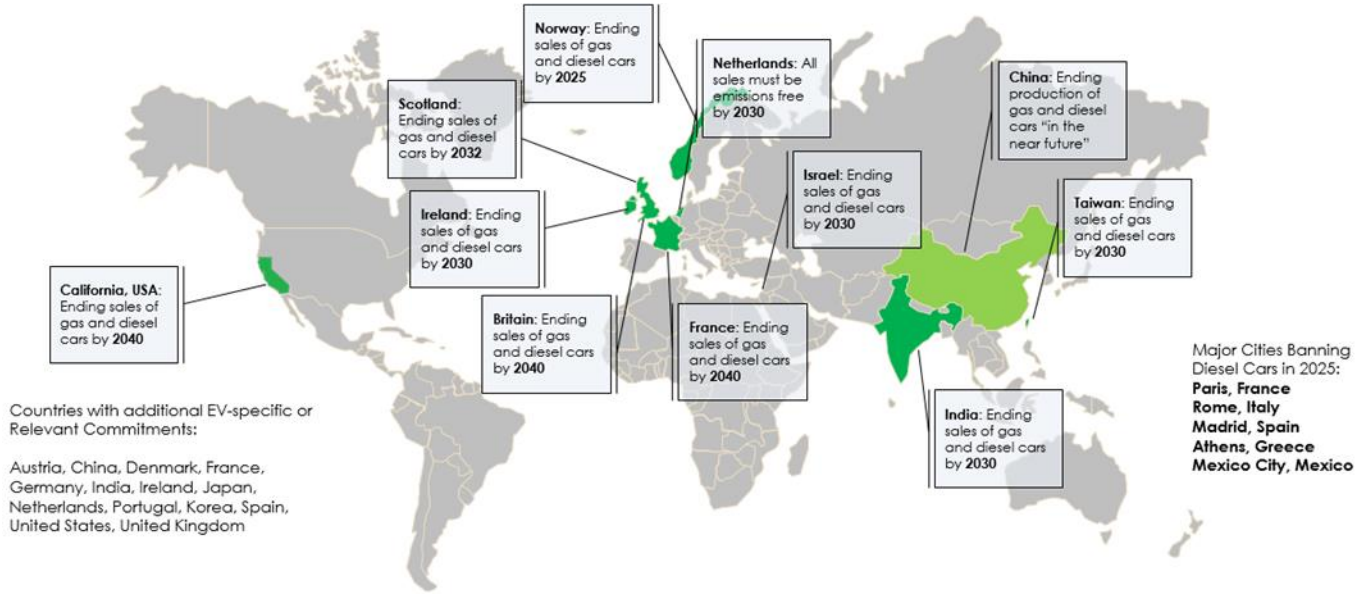

Figure 2. Countries Banning Sale of Gas and Diesel Vehicles

Cadmus then described trends related to the cost and range of electric vehicles. This includes:

- Annual battery electric vehicle (BEV) sales surpassing plug-in hybrid electric vehicles (PHEVs) sales across the United States, including in the Midwest;
- Rapid declines in the price of lithium-ion batteries;
- The increasingly competitive total cost of ownership (including fuel, maintenance, purchase, etc.) of EVs versus internal combustion engine (ICE) vehicles; and
- Increasing average ranges of EVs that meet or surpass the average daily vehicles miles traveled (VMT) for residents in the Midwest.

In addition to these trends, it is important to be aware of broader trends in the EV industry in order to effectively plan for EV deployment. Between 2011 and 2017, sales of BEVs and PHEVs increased in the U.S. as a whole, including in the Midwest specifically. In this same timeframe, the number of available EV models has increased, as has the average median range for travelling on a full battery. Sales of light-duty EVs are projected to continue increasing over the next couple of decades, reaching 9% of all light-duty sales by 2025. The personal-use vehicle market is not the only one that has seen an increase in electrification. Vehicle manufacturers have recently focused on the medium and heavy-duty market, providing electric options for vehicles such as delivery vans, tractor trailers, and transit buses.

Additional trends that could influence the trajectory of EV deployment are the long-term economic outlook in the U.S., changes in gasoline and diesel prices, and projections of VMT. Gasoline and diesel prices are anticipated to increase until they reach their peak in 2032 and then level off through 2046, with diesel prices trending slightly higher than gasoline prices. Total VMT for all vehicle types is

"projected to grow at an average rate of 1.2% annually in the 20 years through 2036" and then slow significantly between 2036 and 2046, resulting in an average annual growth rate of 0.9% over the 30-year forecast period. This growth rate is smaller than in the past 30 years, when the average annual VMT growth rate was 2.0%.[1]

Cadmus also noted other factors that are likely to have an effect on EV deployment, although their impact is uncertain. For instance, autonomous vehicles could have a disruptive effect on the ways in which we plan our living and work environments, thus affecting transportation between the two. Furthermore, they could cause changes in VMT and influence both how and where charging infrastructure is installed. Ridesharing trends can also influence EV deployment. Demand for and utilization of EVs for ridesharing could increase due to their lower maintenance and fuel costs, for example. Additionally, the future of EV deployment is inherently tied to broader transportation planning, including plans for multimodal infrastructure.

Discussion was interspersed throughout the presentation. Ameren also presented background information on their initiatives in EVs, their general perspective on the potential for EVs to affect the Ameren's business, including their effects on rates, and the utility regulatory environment in Missouri. Attendees were free to ask questions and comment on the substance of some of the slides. Some noteworthy comments included a focus on:

- The uncertainty of optimally situating EVSE. Cities have found it difficult to determine where they should place prospective charging stations. Attendees expressed a concern that EVSE in poorly placed locations may eventually become stranded or underutilized assets, and may even burden adoption of EVs if EVSE in premium parking spaces are not used. Another participant noted that over the long run, the key locations for EVs will likely be in residences, workplaces, and corridors.
- The uncertainty of EV cost estimates. Due to the relative novelty of EVs, cost estimates remain uncertain. Many BEVs and PHEVs have not yet encountered the end of their life cycles, impacting the ability to aggregate empirical data on actualized ongoing costs. Some luxury brands of EVs may bear higher maintenance and repair costs, although attendees generally agreed that EVs had demonstrated lower maintenance costs and fuel costs thus far. One attendee noted that the degradation of battery life has been substantially less than expected.
- The uncertainty of fast charger costs. While there is a litany of literature on the hardware cost of fast chargers, the actualized all-in cost of such fast charging stations continues to exhibit significant variability, from tens to hundreds of thousands of dollars in some instances. Participants described a wide spectrum of costs for fast charger installation. Much of the variability comes from the installation costs, which includes substantial construction costs that are unique to each fast charger location.

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[1] US Department of Transportation Federal Highway Administration's Office of Highway Policy Information, "Special Tabulations", https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.cfm

- The importance of convenience. Even with fast charging stations, wait times during charging are still a major perceived obstacle to widespread adoption. One participant noted the importance of ensuring that sited EVSE infrastructure is appropriate for estimated dwell times. For example, a fast charger may not be necessary in residences or workplaces, given that most owners of such vehicles will likely dwell long enough in such locations for a sufficient charge from a Type-2 or even a Type-1 charger. Another example for mismatches include the installation of Type-2 chargers in long-term airport parking.
- The promise of school resources. One attendee noted that school property is one potential opportunity to establish charging infrastructure, since schools tend to be in close vicinity to residences, their parking lots are not used during the evenings, and many schools remain under the jurisdiction of the city. Moreover, such chargers could potentially provide leasing revenue to schools. Other commentators remarked that school buses also tend to be popular subjects of pilot programs, since they have long and predictable dwell times.
- The effects of compressed natural gas (CNG) procurement. One participant noted that prior efforts to promote CNG vehicles have colored the views of stakeholders with regards to EVs. In one city, such CNG vehicles were largely seen as a failed investment and thus stakeholders were reticent to invest in other alternative fuel vehicles, including EVs.

Context-Setting for Cities

Following a short break, Cadmus presented on state-level support for EVs, including the rebates, tax incentives and vouchers for the initial up-front costs, and additional subsidies for the operating costs and convenience of EVs, such as exemptions from HOV fees, tolls, and emissions testing. In these respects, the Midwest is distinguished by its lack of state-level support for EVs. There are no tax or rebate incentives at the state level for the up-front cost of EV or EVSE in any of the states in the Midwest. A handful of Midwestern states offers exemptions from emissions testing, but that is a relatively minor benefit that does not drive adoption.

Cadmus provided examples of how some states are working to ensure EV deployment occurs in an equitable way. For example, Pennsylvania and Texas have specific income requirements in order to be eligible for their incentive programs for alternative fuel vehicles. California has a couple of different approaches to ensure low-income and disadvantaged communities have the opportunity to purchase and own EVs. California's rebate program provides an additional incentive for those that meet income requirements, and EVSE loans are more favorable for installations made in multi-unit dwellings and disadvantaged communities.

Cadmus also presented on the regulatory context that drives utility decision-making on EVs. Another distinguishing characteristic of the Midwest is the trend of Midwestern state public utility commissions (PUCs) rejecting the petitions of investor owned utilities (IOUs) to "rate base" their investments into EVSE, or the ability of the utility to recover the costs of their EVSE investments from ratepayers. On both the east and west coasts, the regulatory decisions on utility rate-basing EVSE have largely been the opposite; IOUs on both coasts have been able to invest in EV pilot programs and pass such costs on to

ratepayers. Some Midwestern states, such as Minnesota and Ohio, have pending decisions on the rate basing question.

This spurred discussion in the working group on the implications of "rate base" decisions on the deployment of EVSE. Although rate basing allows utility the means to invest in EVSE and have certainty in the recovery of those costs, others noted - in lieu of attendance by non-utility EVSE developers - that there may be value in allowing a more competitive marketplace to develop for EVSE. Generally, the discussion emphasized the potential tradeoff between an innovative and competitive marketplace and the necessity of installing enough EVSE chargers in the short-term to encourage EV adoption. The representative from Kansas City Power and Light Co. (KCP&L) noted that their decision to build approximately 1,000 EV charging stations was not without risk. In the case of KCP&L, the utility chose to build out such infrastructure without the express assurance that the PUC would allow them to recover that investment from ratepayers.

Cadmus then discussed the implications of rate design, which had already been covered to varying degrees earlier in the Convening. Utility representatives noted the importance of designing rates that encourage charging in ways that least stress the grid and lower rates for ratepayers. Fixed or flat rates offer the least incentive to shift charging to times that would minimize the cost of additional utility investments, and hence the electricity prices levied on consumers. Utility representatives also discussed some of the technical challenges of imposing new rate designs - for example, a specific EV rate would likely require the installation of a new meter. Others focused on the capabilities of such meters, such as advanced metering infrastructure (AMI), that could allow for more detailed data on energy use.

Cadmus also emphasized the detrimental impact of demand charges on EV charging business models. Substantial demand charges can undermine business models for EVSE since EV charging can lead to significant power draws at any given moment in time. Utility representatives highlighted some of the innovative means by which charging entities are dealing with this challenge, such as installing a battery in the EVSE charging facility, or potentially eliminating demand charges entirely.

Finally, Cadmus briefly highlighted other factors that are unique to a city's context that could affect the demand and return on investment for EVs. Such factors include housing, suburban/rural environments, weather, the presence of a regional charging corridor, among others. Multi-unit dwellings face particularly unique and difficult challenges to EVSE installation, such as physical constraints and the reticence of building owners to install chargers that may not necessarily be used by future tenants.

A summary of contextual factors for each Participating Community are presented in Table 1.

Table 1. Summary of Participating Community Contextual Factors

			Dubuque, IA	Des Moines, IA	Iowa City, IA	Evanston, IL	Indianapolis, IN	Columbia, MO	Kansas City, MO	Springfield, MO	St. Louis, MO	Lincoln, NE
State Context	Financial Incentives for the Purchase of EV or EVSE	Rebates	No	No	No	No	No	No	No	No	No	No
		Vouchers	No	No	No	No	No	No	No	No	No	No
		Tax Incentives	No	No	No	No	No	No	No	No	No	No
	Additional Incentives	HOV Access	No	No	No	No	No	No	No	No	No	No
		Toll Discounts	No	No	No	No	No	No	No	No	No	No
		Emissions Test Exemptions	No	No	No	Yes	No	Yes	Yes	Yes	Yes	No
	Additional State Commitments		No	No	No	No	No	No	No	No	No	No
State Market	Demand Growth	BEV 2012 Sold	49	49	49	371	90	123	123	123	123	44
		BEV 2017 Sold	140	140	140	2391	498	619	619	619	619	102
		% Change	186	186	186	544	387	403	403	403	403	132
		PHEV 2012 Sold	292	292	292	1239	278	358	358	358	358	132
		PHEV 2017 Sold	293	293	293	1421	495	531	531	531	531	158
		% Change	0	0	0	15	78	48	48	48	48	20
	Average VMT (# of miles)		28	28	28	22	32	31	31	31	31	28
	E-Gallon Price ($)		0.99	0.99	0.99	1.13	1.03	0.9	0.9	0.9	0.9	0.93
	Gasoline Price		2.52	2.52	2.52	2.43	2.43	2.43	2.43	2.43	2.43	2.43
Local Utility Context	Major Utility in the City		Alliant Energy	MidAmerican Holdings Company	MidAmerican Holdings Company	Commonwealth Edison Co.	Indianapolis Power and Light Company	Columbia Water and Light	Kansas City Power & Light Co.	City Utilities	Ameren Missouri Co.	Lincoln Electric System
	Ownership Type		IOU	IOU	IOU	IOU	IOU	Municipal Utility	IOU	Municipal Utility	IOU	Municipal Utility
	Regulatory Characteristics	Can include EVSE in the Rate Base?	N/A	N/A	N/A	N/A	N/A	No	No	No	No	N/A
		Rate Design?	Time-of-Date Rate	Time-of-Date Rate	Time-of-Date Rate	Time-of-Date Rate	EV-Specific Rates	Seasonal-Varying Rate	Seasonal-Varying Rate	Seasonal-Varying Rate	Pilot Time-of-Day Rate	Seasonal-Varying Rate
		Retail Choice?	No	No	No	Yes	No	No	No	No	No	No
City Context	Number of EV Charging Stations		5	11	6	15	36	5	152	16	19	16
	Estimated Emissions vs. Gasoline (grams of Co2e per mile)	BEV	202	202	202	206	206	263	231	263	263	202
		PHEV	235	235	235	237	237	268	250	268	268	235
		Gasoline	381	381	381	381	381	381	381	381	381	381
	Housing Stock Composition	Less than or equal to 4 Units (%)	86	73	63	51	76	72	76	75	77	75
		More than 4 Units in Building (%)	10	24	36	49	23	26	23	24	23	24

Additionally, during this session participants were asked to fill out a worksheet rating policies and initiatives from 1 (low) to 5 (high) on their relevance, feasibility, and potential impact. Overall, engaging the utility on EV and EVSE goals was rated the highest in all three areas, with average ratings of 5.0, 4.8, 4.8, respectively. Reducing city excise taxes on vehicles was rated the lowest in all three areas, with average ratings of 2.0, 1.0, and 1.5, respectively.

Engaging the utility on EV and EVSE goals, running educational campaigns, and sharing information on EVSE permitting and EV use were considered the top three best policies by participants. Participants rated "engage the utility on EV and EVSE goals" and "share information on EVSE permitting and EV use" as equally the most relevant and feasible policies, with average ratings of 5.0 and 4.8, respectively. Participants rated "engage the utility on EV and EVSE goals" and "run educational campaigns" as equally the most impactful policies, with an average rating of 4.8. Figure 3 shows participant worksheet responses, presented with strategies whose summed relevance, feasibility and impact were rated highest at the top.

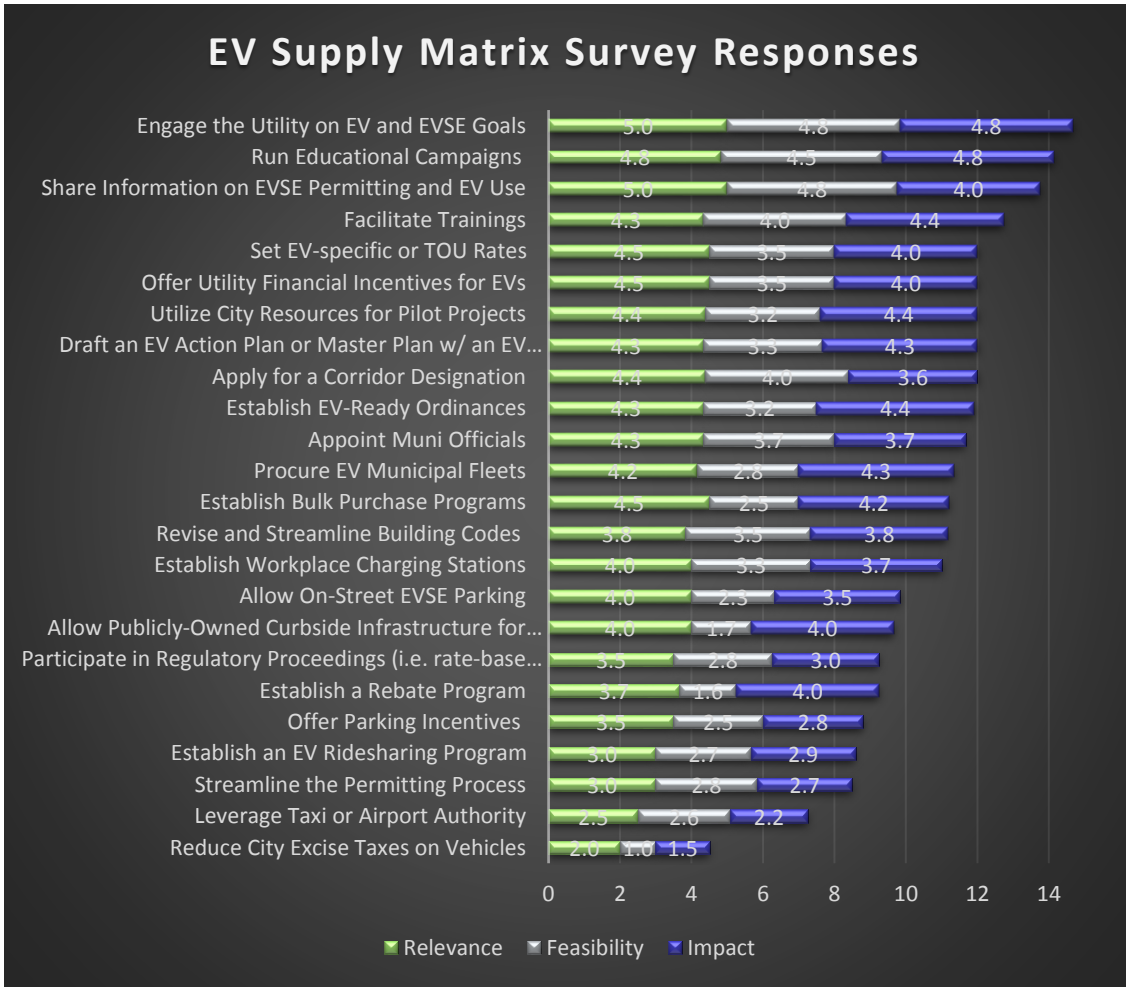

Figure 3. Participant Survey Responses

Furthermore, Table 2 shows participant worksheet responses grouped into categories: Consumer-oriented strategies, Municipality-oriented strategies, and Utility-oriented strategies.

Table 2. Participant Survey Responses by Strategy Category

EV SUPPLY MATRIX	Average Rating (1 - low, 5 - high)		
CONSUMER-ORIENTED STRATEGIES	Relevance	Feasibility	Impact
Establish **Bulk Purchase Programs**	4.5	2.5	4.2
Run **Educational Campaigns**	4.8	4.5	4.8
Apply for a **Corridor Designation**	4.4	4.0	3.6
Offer **Parking Incentives**	3.5	2.5	2.8
Establish **EV-Ready Ordinances**	4.3	3.2	4.4
Allow **On-Street EVSE Parking**	4.0	2.3	3.5
Streamline the **Permitting Process**	3.0	2.8	2.7
Facilitate **Trainings**	4.3	4.0	4.4
Revise and Streamline **Building Codes**	3.8	3.5	3.8
Establish a **Rebate Program**	3.7	1.6	4.0
Reduce City **Excise Taxes on Vehicles**	2.0	1.0	1.5
Establish an **EV Ridesharing Program**	3.0	2.7	2.9
Leverage **Taxi or Airport Authority**	2.5	2.6	2.2
MUNICIPALITY-ORIENTED STRATEGIES			
Procure **EV Municipal Fleets**	4.2	2.8	4.3
Draft an **EV Action Plan** or **Master Plan** w/ an EV component	4.3	3.3	4.3
Establish **Workplace Charging Stations**	4.0	3.3	3.7
UTILITY-ORIENTED STRATEGIES			
Engage the Utility on **EV and EVSE Goals**	5.0	4.8	4.8
Share Information on **EVSE Permitting and EV Use**	5.0	4.8	4.0
Participate in **Regulatory Proceedings** (i.e. rate-base proceedings)	3.5	2.8	3.0
Utilize City Resources for **Pilot Projects**	4.4	3.2	4.4
Appoint **Muni Officials**	4.3	3.7	3.7
Allow Publicly-Owned **Curbside Infrastructure for EVSE**	4.0	1.7	4.0
Offer Utility **Financial Incentives for EVs**	4.5	3.5	4.0
Set **EV-specific or TOU Rates**	4.5	3.5	4.0

In terms of strategy type, participants generally rated utility-oriented type policies as the most relevant policies with an average of 4.4, whereas municipality-oriented policies and consumer-oriented policies received an average of 4.2 and 3.7, respectively. Utility-oriented policies were also rated the most

feasible (3.5), however all three strategy types were considerably lukewarm, with municipality-oriented policies rated slightly lower (3.2) and consumer-oriented the lowest (2.9). Municipality-oriented policies were considered the most impactful (4.1), with utility-oriented policies nearly equal (4.0) and consumer-oriented policies the least impactful (3.4). Figure 4 presents the average worksheet responses by strategy type.

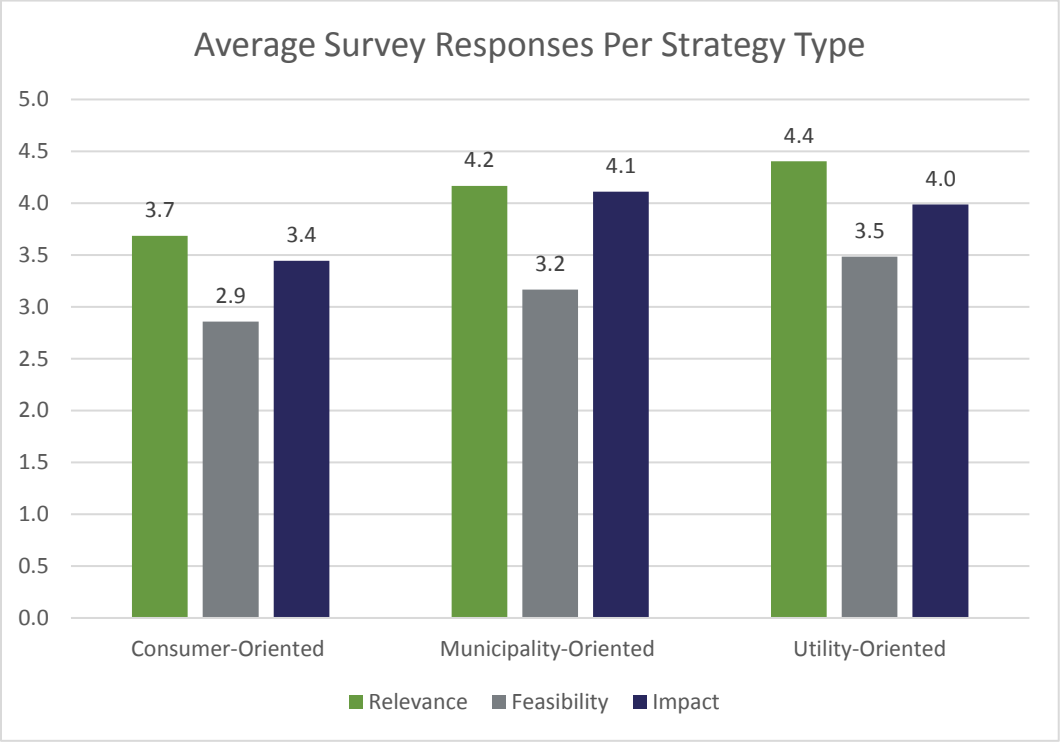

Figure 4. Participant Survey Responses Averaged Across Strategy Categories

Policy Options and Resources

The following discussion on policy options and resources was split between the end of the first day and the beginning of the second day. To kick off discussion, a representative from the Iowa Clean Cities Coalition described the resources that the Coalition offers to cities seeking to deploy EVs and EVSE in their jurisdictions. Such resources include the Alternative Fuels Data Center, which hosts a broad array of research and educational materials, including information on laws and incentives, data, interactive tools, and others. The site also includes an Alternative Fuel Station Locator and tools for calculating the financial viability of fleets powered by alternative fuels, including electric vehicles. The Clean Cities Coalition also offers a broad variety of additional services, including outreach and education, project planning, fleet analysis, and grant management. Finally, the Clean Cities Coalition representative outlined steps that cities can take to prepare for and take advantage of Volkswagen (VW) settlement funding. The steps included commenting on state plans for fund allocation, identifying sites for EV charging and fleet vehicles eligible for replacement, monitoring the development of EV deployment-related tools, creating outreach materials for fleets, and convening stakeholders.

The attendees then concluded discussion for the first day by taking a tour of Columbia, MO in an electric bus. A city transportation manager led the tour, taking the group past the major renewable installations in Columbia, MO, while providing details on the cost, design, and technical attributes of electric buses.

The next day, Cadmus began the discussion by describing broader strategic approaches towards EV policy. This included highlighting that transportation emissions recently surpassed power sector emissions in the United States, and the increasing utility of strategic (or beneficial) electrification, which is defined as "powering end uses with electricity instead of fossil fuels in a way that increases energy efficiency and reduces pollution, while lowering costs to customers and society, as a part of an integrated approach to meet energy and climate goals."[2]

Cadmus then provided a broad overview of its policy research conducted thus far, noting that the barriers for consumers largely fall within the realm of:

- Cost (i.e. whether the up front and the total cost of ownership of EVs is comparable to the cost of an equivalent ICE)
- Infrastructure (i.e. whether there are convenient and accessible chargers with an adequate charging capability that matches dwell times)
- Awareness and Education (i.e. whether consumers are purposefully seeking EV models when they are in the market for a new vehicle, and whether consumers are aware of the incentives for EVs).

These barriers outlined aligned with how the utility representatives described the challenges for EVs. Cadmus then described some of the barriers facing utilities, including: infrastructure upgrades, access to data, rate design, metering capabilities, billing arrangements, and consumer engagement.

Finally, Cadmus provided a broad overview of the policies that cities have undertaken to deploy EVs. Some of the most prominent and feasible consumer-oriented actions include bulk procurements, establishing EV-Ready building codes and ordinances, and streamlining the permitting process. Drive Electric Northern Colorado offers an excellent example of the value of bulk procurements, and Raleigh, NC has undertaken significant efforts to streamline and hasten their EVSE permitting process. Cities such as Atlanta, GA, have sought to establish EV-ready building codes, which can drastically lower the overall cost of retrofitting buildings to support EVSE. Cities can also use EVs in municipal operations, such as procuring EVs for their fleets of light and heavy-duty vehicles, or by placing EVSE in publicly available community spaces or city-owned parking locations. Finally, cities can engage utilities on their plans for EVSE, support utilities in regulatory proceedings, and share information relevant to utilities, such as anticipated load and installations of EVSE within their jurisdictions.

[2] Northeast Energy Efficiency Partnerships, "Strategic Electrification: An Energy Transformation," https://neep.org/blog/strategic-electrification-energy-transformation

The discussion group also flagged some additional areas worth further exploration. The feedback from the group included:

- Providing permitting and zoning checklists related to EV charging infrastructure;
- Flagging the need for culturally relevant marketing and outreach materials;
- Identifying opportunities at hospitals and other "shift-labor" facilities and how they can accommodate the strategic deployment of EV charging infrastructure; and
- Looking at opportunities to adapt street lights to accommodate EV charging.

Resources Provided Following the Convening

Following the convening, Cadmus shared several resources. These include:

- Permit for Charging Equipment Installation Electric Vehicle Supply Equipment (EVSE) and Checklists. This template from the Department of Energy's Alternative Fuels Data Center contains an application for installation of EV charging equipment, information on permit code, and useful diagrams. In addition, the Permit includes an EVSE load calculation worksheet. This is an effective tool for residences to anticipate and calculate electric load on dwellings.
- 2017 Checklist for Installing Non-Residential Electric Vehicle Charging Station (EVCS) at Existing Facilities. This checklist from the City of Calabasas, CA, provides a list of compliance requirements for electric vehicle charging stations in non-residential facilities. It serves as a useful example of a guidance resource that a city might offer.
- Plug-In Electric Vehicle Infrastructure Permitting Checklist. This checklist from the California Plug-In Electric Vehicle Collaborative outlines the necessary steps required for a plug-in electric vehicle (PEV) owner to take when applying for an electric vehicle supply equipment permit. It provides guidance for both residential and non-residential EVSE facilities and suggests ten additional educational resources for PEV owners. It serves as a useful example of a guidance resource that a city might offer.
- Checklist for Multi-Family Residential Electric Vehicle Charging Station. This checklist from the City of Healdsburg, CA, offers an outline with requirements for EV charging stations, categorized by type of charger and by the Article 625 2016 California Electric Code. The checklist categorizes electrical code requirements by charger type. It is also an example of guidance a city could provide.

Report-Out from Focus Groups

Feedback from the focus groups was varied, with few disagreements and no clear themes emerging for all parties.

Several focus groups noted that the awareness of EVs is insufficient. A few stressed that EV marketing should be culturally relevant. Also, education about energy usage, cost savings, and the environmental

benefits of EVs could encourage consumers to purchase or use EVs. While dealerships acknowledge the substantial demand for EVs, the market is still not large enough for dealerships to justify running a marketing campaign; participants highlighted this as a potential area for city assistance. It was also suggested that cities increase transparency about their actions regarding EV infrastructure and deployment of charging stations. Others noted the importance of getting youth communities involved, particularly millennials. Finally, some utilities have also offered commissions to dealerships for sales of EVs, suggesting that they could also be partners in raising awareness.

There was also a consensus that while some stakeholders in city jurisdictions might expect that the city will be the owner of public infrastructure, city officials noted that this was, in many instances, neither feasible nor desirable, since this does not fall under the city's expertise and in some cases, exceeds its budgetary constraints, or is politically infeasible. However, other participants noted that the private ownership of EVSE is often not economically scalable, suggesting that there is some need for public charging. Participants discussed how declining gas taxes and permitting fees would need to be taken into consideration to ensure that EV efforts do not have a detrimental impact on the budget.

One useful insight was that gas station owners are not interested in EVSE, since their business model often relies on the "churn" of customers in and out of their businesses, and EV charging often has long wait times. Another insight is that for municipal operations, often the vehicles best suited for EVs do not come back to the same building at the end of the day, presenting challenges for siting EVSE in municipal buildings.

Multiple groups discussed some common barriers to EV adoption:

- Lack of education and awareness
- Social inequity for low- to moderate- income households
- Lack of dedicated parking and space for charging stations at multi-family complexes
- Uncertainty regarding future electric demand and the need for EV charging stations

Participants also mentioned a handful of additional policies that will be included in the Primer:

- A few city officials also highlighted the growing focus on ensuring the "right to charge," or the ability of residents in multi-unit dwellings to pay and install charging stations in their garages.
- Another potential policy option is related to the city's adoption of IECC codes related to EVs.

Finally, participants generally mentioned the broad variety of unknowns in their decision-making, and potential solutions. Open questions include:

- How to more thoroughly integrate equity into these proposals;
- How to determine criteria determining how many and where to place EVSE;
- How to further incentive private participation in EV parking spots;
- How to quantify goals and metrics for EVs in master plans;
- Resources for technical assistance related to EVs.

Specific major takeaways from each Focus Group are presented in Table 3.

Table 3. Focus Group Takeaways by Participating Community

	Major Insights
St. Louis, MO	- Major factors that affect EV growth are being a coal heavy state, education (both from dealer and organizations), limited range, incremental costs and money (especially due to the city's budget crisis), and barriers to home charging due to apartments, condos, and street parking - Factors of uncertainty and concern are changing gas prices in the future (i.e. lower gas prices could make it harder to make the case to purchase EV), battery life, available technical support, and proximity to repair shops - Incentive programs, grants, and technical support may help reduce EV uncertainties - The city can facilitate EV growth through education, sustainability plans, and being citizen or policy driven. - There is a slight tension between a municipal preference to have EV infrastructure sourced with clean (renewable) energy, vs the economic reality of adding solar canopies for EV charging.
Columbia, MO	- Need more city-private partnerships to gather financial support - Offer financial incentives to private businesses for installing initial EV chargers - Young people and CPS should be included in these discussions - Can implement a carbon footprint tax on non-alternative fuel vehicles - Need to make economic benefits the primary driver for EVs (i.e. avoided maintenance costs; external/environmental costs), rather than primarily environmental benefits - Educate people about energy usage to show cost savings from switching from gas to EV - Ideas for where to add EV chargers include parking garages, rarely used metered spots, conduit at new constructions, and multi-family homes (requirement for property owners) - Lower the price through bulk purchasing EV fleet vehicles with surrounding communities - Provide EV car sharing options (i.e. at churches, the housing authority) to increase equity in low income area. However, people may be more careless with vehicles that they do not own - Disagreements include: - If business decisions to include EV chargers should be driven by competitive advantage vs. policy - Increasing overall fueling costs vs. adjusting cost based on kWh consumption and electrical demand at time of fueling
Evanston, IL	- Should incentivize fleet managers in addition to consumers and consumer vehicles - Short term charging access focused on access within the home can build user confidence - Real-time pricing may offer benefits to EV owners - Create a model policy that everyone accepts to grease the rails for future infrastructure projects - Offer incentives for fleets to use EVs (i.e. cheaper registration; tax incentives)
Kansas City, MO	- Use technology to help consumers identify charging locations (i.e. PlugShare app) - Barriers include inequity for low- to moderate- income households, tendency to consider front-end costs (which currently favor gas-fueled vehicles) rather than life-cycle costs (which are lower for EVs), limited range for one car families, insufficient fast-charge stations, and limited EV inventory - The city should assess the effect of demand charges for charging station hosts - The city should consider charging fees by kilowatt hours since this would not be considered a resale of electricity and therefore avoid conflicting with the MO law that no entity can charge for electricity except for utilities

	- Utilities and City departments can coordinate electricity buildouts so EV infrastructure is installed before streets are constructed, rather than tear out already built streets - Encourage widespread deployment of EVs by requiring new construction projects to include EV infrastructure through City policy, providing safe and secure EV infrastructure where people live and work, as well as in-between, and installing charging locations in workplaces that have three shifts - Suggestions for marketing EVs in Kansas City include normalizing the use of EVs as a commonly accepted choice rather than an anomaly, using culturally relevant messages, and depicting EVs as "status" vehicles that people find exciting and enjoyable - Suggestions for addressing distributional equity include: identifying strategies that counter common misconceptions about EVs, placing charge stations where people perceive EVs to be unattainable, using culturally relevant marketing to explain savings in long-term operational costs, offering financial incentives such as time-of-sale offers or sliding-scale rebates, and establishing car-sharing programs
Lincoln, NE	- Need more public outreach, such as traveling tents for Earth Day and other ride and drive events - Need to address range anxiety - Usage data demonstrates a lot of out of area/state user charging in Lincoln - Charging stations need to be located with destinations/user experience in mind – whatever creates the most value for the consumer - City Fleet is looking at aggressive purchasing plan in next few years for pool vehicles - Need to continue to tap grant resources (NET, NDOT) and VW settlement - Concern about the need to develop a secondary EV market - Should include the state's Department of Environmental Quality in future discussions - The NCEA has developed a significant amount of data and research relative to EV usage in Nebraska and has proposed a statewide network for VW funding that can be found at: http://www.necommunity.energy/resources/. - There was consensus in establishing an EV working group or "strike force"
Iowa City, IA	- Interest in seeing locations of EVs in neighborhoods to assess potential grid impacts - Interest in assessing the demographics (i.e. gender, age, etc.) of who is buying EVs - Concerns on quietness of EVs and pedestrian safety - Should address people's interest to know how to estimate EV ownership based on their individual driving habits and what vehicle to choose - The ideal consumer is in town and can take advantage of regenerative braking and low speeds, whereas some EVs may not have the suitable range for out-of-town commuters - Concerns about what is happening or will happen with battery recycling - The city adopted the 2015 National Electrical Code, which included specific provisions to prepare houses' electrical wiring for electric vehicle charging infrastructure. There is question regarding the awareness of this feature among homeowners and prospective buyers and whether there is a way to identify houses built to that code and inform them they are EV-ready. - If there aren't opportunities for EV charging in multi-unit dwellings, then people might be more inclined to buy single-family houses, moving away from denser areas the city is trying to encourage. - Interest in a group buy program - Identify private parking lots that have underground conduit laid for EV charging station and contact the owners if/when money becomes available for charging stations - Charging stations investments should be made transparent (i.e. where to place them, promotion once stations are installed, and signage for wayfinding) - Use tools to decide whether to set a target number of EV stations based on population or number of EVs. For example, the National Renewable Energy Lab's "EVI-Pro" tool can generate certain targets (public, workplace, Level 2 versus DC fast charging, etc.) based on a variety of data points. This tool has already been used in Columbus, Ohio and the state of Massachusetts.

- Would like more hybrid shuttle buses, including through the state bid or DOT. Many of the larger electric buses available today are too tall to go under a bridge on Iowa Ave.
- Provide promotional materials to tourists that have electric vehicles about how to use transit and bike-sharing while a vehicle is charging. This brought up interest in assessing how to locate charging stations near transit or bike-sharing stations.

Appendix: Agenda for Convening on Pathways to EV in the Midwest

Agenda for the Convening on City Planning for EV Growth

Conference room 1A, 701 E. Broadway, Columbia, MO 65201 | April 17-18, 2018

Session Length	Topic	Content	Format	Presenter / Facilitator
April 17: 12:00 - 1:00	**Lunch and Introductions**	• Welcome to Columbia, MO • Overview of grant and project • Introductions (Name and city/organization) • 3-4 volunteers to share a question or issue • Session goals, agenda overview • *Request to hold questions given group size; reiterate discussion focus of following sessions*		• Barbara • ***John Glasock, City of Columbia***
1:00 - 1:45	**Context and Trends for EVs**	• U.S. trends in EVs and EVSE • International trends • Opportunities/drivers • Future "unknowns" • State, utility, and city contexts	Presentation	• Chad, Bobby • ***Pat Justis, Ameren Missouri***
1:45 - 2:15	**Focus Group Feedback**	• Themes of focus group discussions • Report-outs from specific focus groups • Feedback for the EV Primer	Group Discussion	• Chad • ***All: Focus group representatives***
2:15 - 3:00	**Strategic Planning for Deploying EVs**	• Characterize "strategic" vs. "opportunistic" approaches, pro/con • Barriers and strategies	Presentation	• Chad, Bobby • ***Stephanie Weisenbach, Iowa Economic***

Session Length	Topic	Content	Format	Presenter / Facilitator
		• Resources and partnerships		***Development Authority***
3:00 - 3:10	Coffee Break			
3:10 - 4:00	**Context-Based Breakout Groups**	• **Materials & Introduction:** o Participants are presented with **four key questions to answer** (see list in "report-out" in next agenda segment below). o Participants are provided with **worksheet of strategies** (following the EV Primer framework) to reference and complete during and following group discussions (relevance, feasibility, impact) • **Discussion** o Participants report out on individual findings on their worksheet of strategies o Participants engage in lightly facilitated discussion of EV strategies (relevant to the group's shared context) o Facilitators collect worksheets for discussion on Wednesday morning	Facilitated Group Discussion	• Chad, Barbara, Bobby
4:00 - 5:00	Electric Bus Ride / Tour of Columbia, MO			
6:00 - 8:00	Dinner **(Sycamore Restaurant, 800 E Broadway, Columbia, MO 65201)**			

Agenda for the Convening on City Planning for EV Growth

University of Missouri Bond Life Sciences Center, Reading Room 171, 1201 Rollins St. | April 17-18, 2018

Session Length	Topic	Content	Format	Presenter / Facilitator

April 18: 8:00 - 9:30	**Breakfast and Report-Out Session**	• Recap of initial findings from prior group discussion and worksheets
		• **Focused Report Out (4 key questions)**
		  ○ Group facilitator summarizes discussion focusing on specific questions around potential and next steps:
		  ○ "What can be accomplished individually?"
		  ○ "What can/must cities work on together with utilities?"
		  ○ "What actions seemed most feasible and high-impact?"
		  ○ "What challenges would benefit from targeted and external support?"
			Report-outs, group discussion	• Chad, Barbara, Bobby

9:30 – 10:45	**Next Steps**	• Highlighting the top 5 strategies that emerged from workshop discussion
		• Facilitated discussion of:
		  ○ Organizing to implement strategies
		  ○ Leveraging partnerships
		  ○ Sources of support
			Group discussion	• Chad, Barbara

10:45 - 11:00	**Wrap-up and Evaluations**	• Thank you / closing words		• Barbara