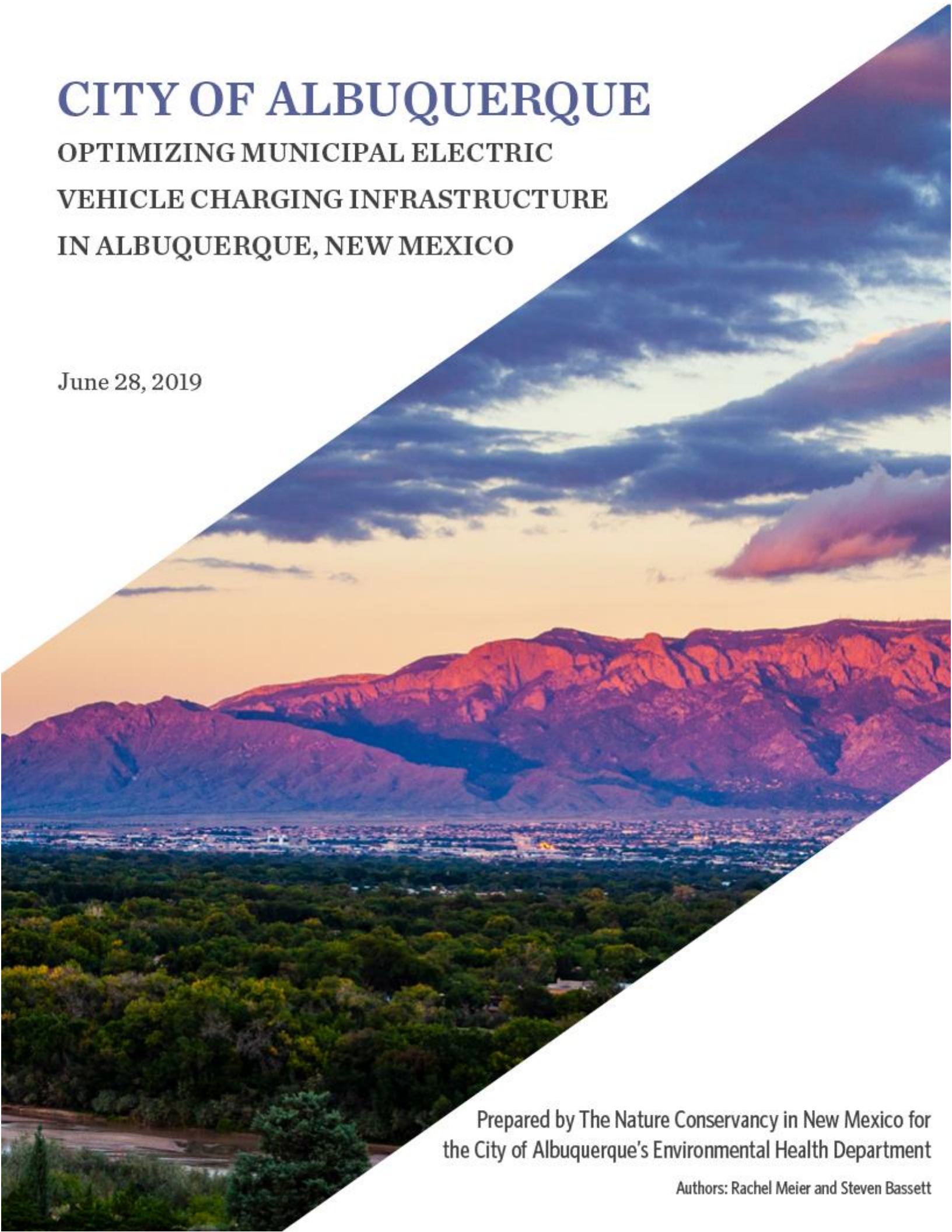
CITY OF ALBUQUERQUE

OPTIMIZING MUNICIPAL ELECTRIC VEHICLE CHARGING INFRASTRUCTURE IN ALBUQUERQUE, NEW MEXICO

June 28, 2019



Prepared by The Nature Conservancy in New Mexico for the City of Albuquerque's Environmental Health Department

Authors: Rachel Meier and Steven Bassett

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Acknowledgements

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Executive Summary

In 2018, Mayor Tim Keller pledged the City of Albuquerque to uphold the goals of the Paris Climate Accord. To meet this commitment the City must reduce its greenhouse gas emissions by 26 percent from 2005 levels by 2025. One strategy to help meet this ambitious goal is to promote increased use and adoption of electric vehicles (EVs) by the City and its residents. Under the American Cities Climate Challenge, Mayor Keller has also pledged to convert 63 percent of the City's eligible light duty fleet to electric vehicles or plug-in hybrids by 2025. Converting the fleet to electric vehicles will allow the City to save money on fuel for its fleet and reduce greenhouse gas emissions.

As the City converts its fleet, opportunities to support the adoption of EVs by residents will also be pursued. Charging infrastructure is required to support the adoption of electric vehicles by the City and residents. Most charging needs can be met by installing charging infrastructure at the locations where vehicles are parked when not in use, though a network of public charging stations throughout the city will allow employees and residents to conveniently charge their EVs when needed. Range anxiety is a significant factor in the adoption of EVs and the existence of stations, and knowledge that stations exist is sufficient to increase EV use, even if those stations will not be used regularly. Providing public charging infrastructure will reduce range anxiety for City employees and residents and increase use of electric vehicles in the city, thereby reducing emissions and improving air quality.

Two analyses were performed and are documented in this report:

1. Light duty fleet conversion opportunities and associated emissions reductions were identified using three fleet conversion scenarios. The vehicles that produce the most emissions annually are recommended for conversion.
2. Potential emissions reductions attained through investments in public charging infrastructure at City-owned facilities were estimated and high return-on-investment (ROI) sites were identified. High ROI sites were screened to ensure equitable distribution of investment throughout the city.

Uncertainty about the funding available for City fleet conversion and the rate of EV adoption by residents is mitigated in this analysis with scenarios capturing a range of plausible conversion and adoption rates.

The light duty fleet conversion analysis suggests that 25 percent of the City's light duty fleet emissions could be eliminated by replacing 24 vehicles with renewable-powered EVs (25.5 kg NOx per year, 137.5 MT CO_2 per year), and that 50 percent of the City's light-duty fleet emissions could be eliminated by replacing 62 vehicles with renewable-powered EVs (51.8 kg NOx per year, 278.9 MT CO_2 per year). Because most of the fleet vehicles with the highest annual emissions are parked overnight in one location, efficiencies in charging infrastructure investments may be attainable.

Investments in charging infrastructure at ten City facilities could reduce emissions between 83.4 – 396.2 metric tons for CO_2 and between 44.3 – 221.9 grams for NOx annually on trips to or from those facilities. These trip-based emissions reductions do not account for the possibility that the new infrastructure would inspire the increased adoption of EVs for all trips by that resident, not just the ones to or from the facility. Assuming the new infrastructure does result in increased adoption of EVs, the net reduction in emissions attributable to the new stations would be much higher. A single charging station can displace 3–7 metric tons of CO_2 every year when built in areas with high demand (County of Santa Clara Office of Sustainability 2018).

Over 130 City facilities were evaluated and ranked to identify the top ten to target for investment in new public charging infrastructure. Daily EV charging demand, associated emissions reductions, and an equity index were modeled for each facility. The ten facilities identified as the best locations for new infrastructure are the most likely to generate the largest reduction in emissions and are equitably distributed throughout the City.

Electric vehicle drivers can save a significant amount of money on fuel when they switch from conventional gasoline-powered vehicles. On average, an EV driver can save over $700 annually, as charging an electric vehicle costs 69 percent less than filling up a tank with gasoline (ChargePoint 2019, U.S. Department of Energy 2018). The price of gasoline is projected to increase so the cost savings associated with switching from gasoline to electricity are expected to persist (Erbas et al. 2018).

If investments in fleet conversion and public infrastructure are made by the City, optimizing those investments based on the results of this analysis will maximize emissions reductions and EV adoption. Reducing transportation emissions is a critical component of the City's strategy to meet its climate goals. Combined with financial incentives for EV ownership and ensuring new development in the City is prepared for the rapid adoption of EVs, this critical emerging technology will significantly reduce the City's transportation emissions and save Burqueños money.

Introduction

It is estimated that, as of 2016, there are more than 500,000 electric vehicles on the road in the U.S. (Wood et al. 2017, Erbas et al. 2018). Since the turn of the 21st century, electric vehicle ownership in the U.S. has increased annually. Demand for EV charging infrastructure in Albuquerque is expected to increase dramatically in the next ten years. Sixteen percent of Americans surveyed in April 2019 say they are likely to purchase an EV the next time they are in the market for a new car (American Automobile Association 2019). Though less than one percent of vehicles sold in New Mexico in 2018 were electric vehicles (0.81%), the growth rate has increased every year since 2015 (Alliance of Automobile Manufacturers 2019). Mass adoption of electric vehicles is expected in the United States by 2028 (McDonald 2019).

The largest barrier to widespread adoption of EVs is range anxiety, including the perception that there are not enough places to charge (American Automobile Association 2019). The purchase price of EVs has decreased to the point that charging infrastructure is the limiting factor in EV adoption (Wood et al. 2017).

There are numerous benefits of EV adoption. Electric vehicle drivers save a significant amount of money on fuel when they switch from conventional gasoline-powered vehicles. On average, an EV driver can save upwards of $700 annually, as charging an electric vehicle costs 69 percent less than filling up a tank with gasoline (ChargePoint Inc 2019, U.S. Department of Energy 2018). The price of gasoline is projected to increase, and it will become even more expensive to drive a gasoline powered vehicle relative to an electric vehicle (Erbas et al. 2018). With as much as 90 percent of gasoline consumption in the U.S. currently coming from light duty vehicles (Dong et al. 2014), conversion to EVs will decrease emissions from the transportation sector.

The transportation sector is the third largest source of greenhouse gas emissions in New Mexico behind electricity generation and the fossil fuel industry (NMED 2016). As recent legislation and administrative

changes decrease emissions in these other sectors, the transportation sector is expected to become the largest source of emissions in New Mexico.

Reducing these emissions is a key component of efforts to combat climate change. In 2018, Mayor Tim Keller pledged that the City of Albuquerque will uphold the goals of the Paris Climate Accord, requiring the City to reduce its greenhouse gas emissions 26 percent from 2005 levels by 2025. Under the American Cities Climate Challenge, Mayor Keller has also pledged to convert 63 percent of the eligible light duty fleet to electric vehicles or plug-in hybrids by 2025.

Currently, the City's light duty fleet is 94 percent gasoline powered and 6 percent hybrid electric vehicles, with 95 percent of the vehicles travelling less than 50 miles on an average workday. The City intends to construct electric vehicle charging stations to support its newly electric fleet as well as provide opportunities for residents to charge their EVs at City facilities. This analysis identifies optimal locations for investments in charging infrastructure to meet both the needs of the City's fleet and electric vehicle owners throughout Albuquerque.

Methodology

Data describing the City's light-duty fleet and City facilities were acquired from the City of Albuquerque. Optimal fleet electrification scenarios and associated charging infrastructure were generated from the fleet data. Optimal locations for investments in publicly accessible charging infrastructure were generated from the facility data.

Fleet Charging Stations

Fleet vehicle parking locations and mileage data was received from the City. Average annual and daily mileage was calculated for each fleet vehicle. Average annual emissions for each vehicle was calculated using a standard emission factor of 404 grams per mile for carbon dioxide (CO_2) emissions and 0.075 grams per mile for Nitrous Oxide (NOx) emissions (Salisbury 2014, US Environmental Protection Agency 2018). The location where each vehicle is parked when not in use was georeferenced from addresses. Fleet vehicle parking locations were mapped and converted to electric vehicle demand using a fleet conversion model. Because a minority of vehicles produce the majority of the emissions, this fleet conversion model assumes the vehicles with the highest annual emissions are converted first. Fleet conversion scenarios representing replacement of the vehicles responsible for 25, 50, and 75 percent of annual emissions were evaluated. Because the highest emission fleet vehicles are parked overnight at a small number of parking lots, infrastructure demand is summarized by the parking lot. One charging station per two EVs is assumed in this analysis though multi-vehicle and fleet charging systems would increase the ratio of vehicles to chargers.

Publicly Accessible and Employee Charging Stations

Facility location data and parking meter location and use data were provided by the City of Albuquerque from existing enterprise datasets. Data characterizing facility visitation rates, operating hours, average visit duration and other pertinent information was collected through a survey of the City's Facility Managers (Appendix A). Other required data were collected from aerial imagery and published data.

To fill in gaps in the facilities data from the Facility Managers Survey, facilities without survey response data were compared to similar facilities with completed survey responses. Data was then estimated using the average value of similar buildings. Facility hours and parking lot data were validated with data from the City of Albuquerque's website and using aerial photographs.

To estimate electric vehicle charging station demand at City facilities, an equation modeling electric vehicle charging demand was created for three EV adoption rate scenarios (one, two and five percent, hereafter referred to as Scenario 1, Scenario 2, and Scenario 3 respectively). Average vehicle occupancies for each facility type were used to estimate the number of vehicles expected at each facility on a daily basis (U.S. Department of Transportation 2009). Estimated daily electric vehicle usage was calculated for both employees and visitors, and then summed to estimate total electric vehicle usage for each facility assuming one, two and five percent EV adoption rates (Equation 1). Both Level 2 (slow charging) and Direct Current Fast Charging (DCFC, or Level 3) station types were considered when making recommendations for City facilities. Charger type recommendations were given based on the number of daily projected electric vehicles at each City facility and verified by the average residence time. Any facility with greater than 10 projected daily EVs in any of the three adoption rate scenarios was recommended at least one DCFC station.

Equation 1. The expected number of electric vehicles to visit each facility is a function of the number of visitors, number of employees, proportion of staff and visitors that arrive in light duty vehicles, average occupancy of light duty vehicles, and the proportion of light duty vehicles that are electric.

$$EV_D = \left(\frac{\left(\frac{V_A}{O_A}\right) \times P_V}{O_V} + \frac{\left(\left(\frac{E_P}{2}\right) + E_F\right) \times P_E}{O_E} \right) \times EV_A$$

Where:
EV_D is the average daily number of electric vehicles expected to visit the facility
V_A is the annual number of visitors to the facility
O_A is the annual number of days that the facility is open to visitors
P_V is the proportion of visitors that arrive in light duty vehicles
O_V is the average number of visitors per light duty vehicle
E_P is the number of part-time employees at the facility
E_F is the number of full-time employees at the facility
P_E is the proportion of employees that arrive in light duty vehicles
O_E is the average number of employees per light duty vehicle
EV_A is the proportion of light duty vehicles that are electric

Emissions reductions from the conversion of conventional fuel vehicles to electric vehicles was calculated for Nitrous Oxide (NOx) and carbon dioxide (CO_2) using per-mile emissions factors (0.075 grams per mile of NOx from Salisbury 2014 and 404 grams per mile of CO_2 from US Environmental Protection Agency 2018). These emissions reductions were then multiplied by the average trip length by trip type: 12.2 miles for employee commutes, 11.2 miles for visitors making trips for social-related purposes, 7.1 miles for visitors making trips related to errands, and 9.7 miles for visitors to medical-related facilities (U.S. Department of Transportation 2011). Trip types were assigned based on the facility type. Expected per trip emissions reductions were then multiplied by the number of daily projected EVs at each facility

for all three scenarios. Annual emissions reductions for installing EV charging infrastructure at each facility were calculated by multiplying the average EVs per open day by the annual number of open days.

To ensure investments in charging infrastructure are distributed equitably throughout Albuquerque, priority locations for charging infrastructure are distributed evenly across a census block-group level index of poverty and educational attainment. Based on the methods used in a similar analysis completed for Denver (Shimomura 2018), the proportion of families in poverty and adults over 25 years of age without a high school diploma or equivalent were determined for census block-groups within the City of Albuquerque boundary (U.S. Census Bureau 2017). These values were then averaged together for each block-group to create a socioeconomic status index (Equation 2).

Equation 2. A socioeconomic index was tabulated based on U.S. Census Bureau data to ensure investments in charging infrastructure are distributed equitably across the City.

$$E_I = \frac{\left(\frac{F_P}{F_T}\right) + \left(\frac{A_D}{A_T}\right)}{2}$$

Where:
E_I is an index of socioeconomic status for this block-group
F_P is the number of families living below the federal poverty line
F_T is the total number of families
A_D is the number of adults over the age of 25 without a high school diploma or equivalent
A_T is the total number of adults

Socioeconomic status index values for all census block-groups were divided into four quartiles to generate a socioeconomic category value between 1 (more wealth and education) and 4 (less wealth and education). Facilities were assigned the socioeconomic category of the census block-group where the facility is located. The three City facilities with a socioeconomic status index value of 3 and 4 and with the greatest expected reduction in emissions are recommended for development of charging infrastructure. Additionally, the top two City facilities with a socioeconomic status index value of 1 and 2 and with the greatest expected reduction in emissions are recommended for development of charging infrastructure.

To evaluate the availability of currently existing charging infrastructure to meet the expected demand, existing publicly available EV charging station infrastructure was mapped (New Mexico 2018). The socioeconomic category for each existing station was identified, though the current socioeconomic distribution of stations was not used to inform future investments. Existing charging infrastructure is concentrated in the center of the city and tend to occur in areas with lower socioeconomic index scores (Figure 1). Because existing charging infrastructure is unlikely to meet expected demand, the expected demand model does not consider existing charging stations.

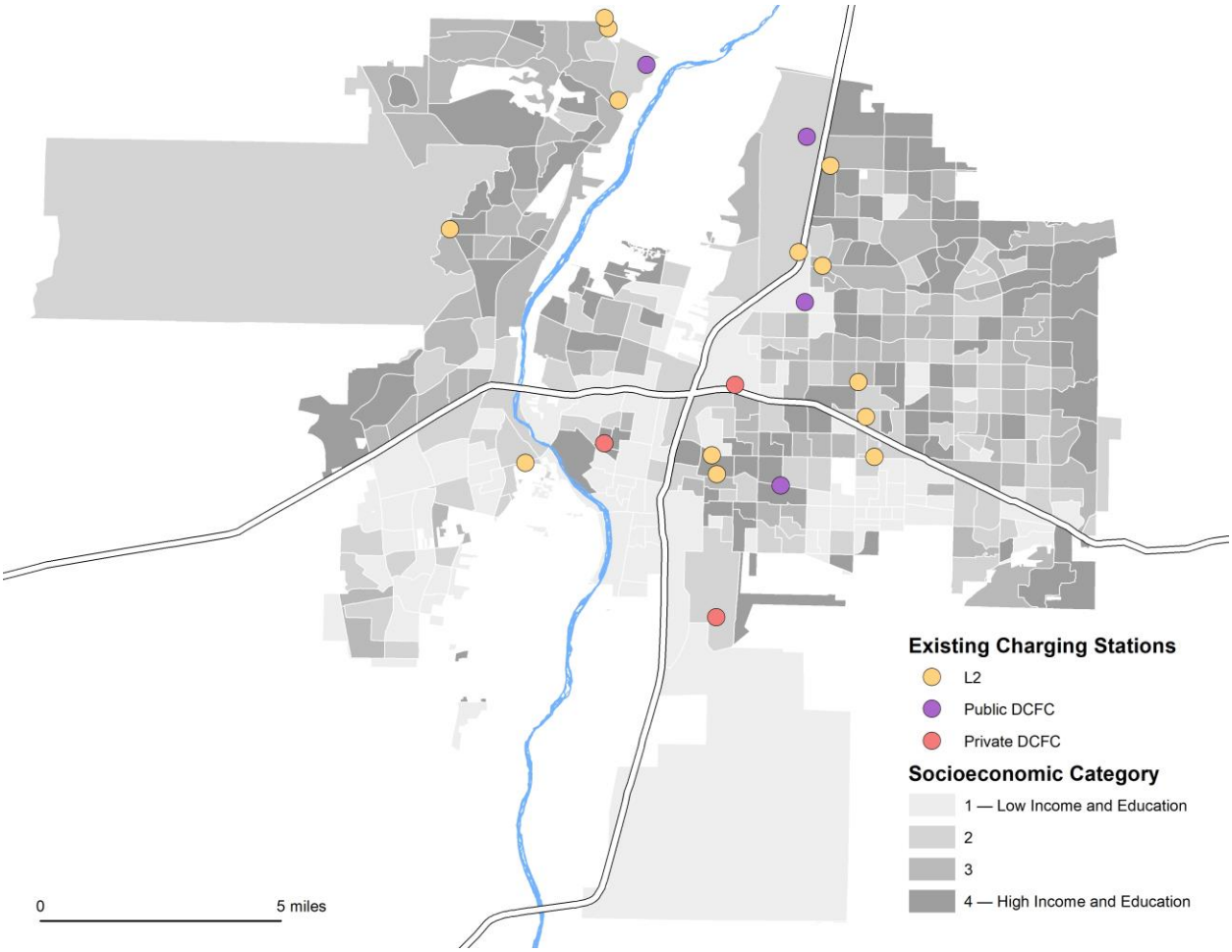

Figure 1. This map depicts the current location of publicly available electric vehicle charging stations in Albuquerque by charging station type [Level 2 (L2), Direct Current Fast Charging (DCFC)]. Private DCFC stations are Tesla Supercharger stations. The socioeconomic status category is displayed by census block-group, with lighter shades indicating areas with lower income and educational attainment.

Results

The City's light duty fleet vehicles are primarily concentrated in three places: the Daytona/Yale facility, the Pino Yards, and the Civic Plaza Parking Garage. Significant emissions reductions can be achieved by converting the fleet vehicles that produce 25 percent of the fleet's emissions. For the public charging station analysis, the most simulated daily electric vehicles in all adoption rate scenarios occur at the Albuquerque BioPark, City Hall, and Isotopes Stadium. By converting the top ten recommended facilities, the City has the opportunity to reduce CO_2 emissions by as much as 421 metric tons annually.

Fleet Charging Stations

The City of Albuquerque has a fleet of 255 light duty vehicles housed at 36 different facilities across the metropolitan area. The majority of these vehicles (n=240) are driven less than 50 miles on an average workday. Of the 15 vehicles that are driven more than 50 miles on an average workday, ten are parked at the Daytona/Yale Facility, two are parked at the Civic Plaza Parking Garage, one is parked at the Senior Affairs facility, and one is parked at the Heading Home Shelter. The locations housing the largest number

of parked light duty fleet vehicles are the Daytona/Yale Facility, Civic Plaza Parking Garage, and the Pino Yards with 40, 38 and 36 vehicles respectively.

Fleet charging station recommendations are provided under three fleet conversion scenarios. If the fleet vehicles that produce 25 percent of light duty fleet emissions are converted to electric, a total of 24 vehicles would be converted with an estimated annual emissions reduction of 26 kg of NOx and 137 metric tons of CO_2. If the fleet vehicles that produce 50 percent of light duty fleet emissions are converted, a total of 62 vehicles would be converted with a reduction of 52 kg of NOx and 279 metric tons of CO_2 annually. If the vehicles that produce 75 percent of light duty fleet emissions are converted, a total of 120 vehicles would be converted with an annual reduction of 78 kg of NOx and 418 metric tons of CO_2. The vehicles identified for conversion and the recommended charging infrastructure to support these vehicles is described in Appendix B.

The ten fleet vehicles with the highest annual emissions are specifically identified as high priorities for electrification. These ten vehicles are parked at three locations when not in use (Figure 2). Converting these ten vehicles would reduce fleet emissions of CO_2 by 67.48 metric tons annually (Table 1).

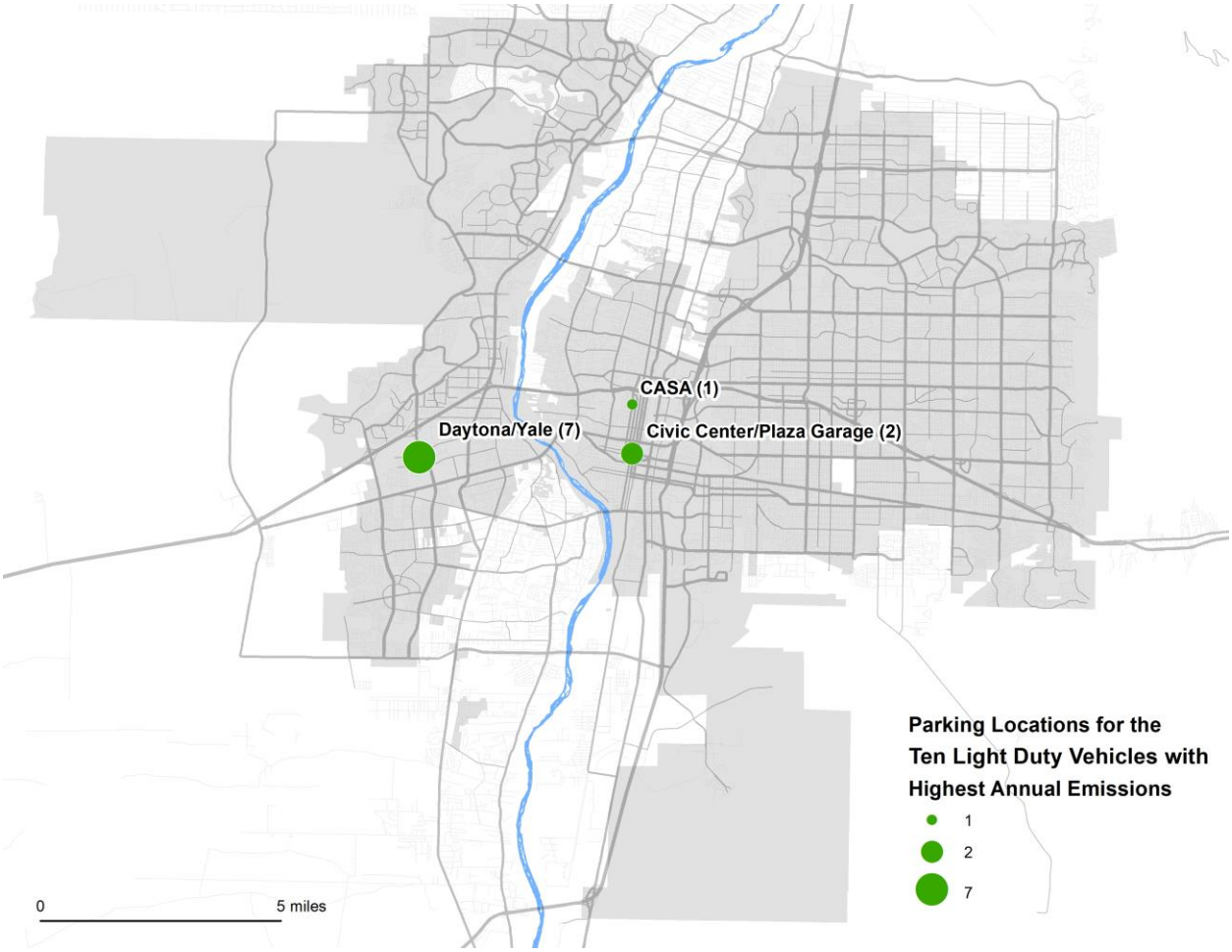

Figure 2. This map shows the parking locations of the ten light duty fleet vehicles that produce the most emissions annually. Converting these ten vehicles will produce the greatest annual reductions in Nitrous Oxides (NOx) and carbon dioxide (CO_2) emissions on a per-vehicle basis. These vehicles are housed nightly at the Daytona/Yale facility, Civic Center/Plaza Garage, and Senior Affairs lot.

Table 1. This table shows the top ten City fleet vehicles ranked by annual miles driven. It is recommended that these ten vehicles be converted immediately, as these vehicles will produce the greatest reductions in NOx (Nitrous Oxides) and CO_2 (carbon dioxide) emissions. Annual emissions reduction estimates for NOx are reported in kilograms (kg) and CO_2 are in metric tons (MT).

Vehicle Ranking	Parking Location	Average Annual Vehicle Mileage	Average Daily Vehicle Mileage	Annual NOx Emissions Reductions (kg)	Annual CO_2 Emissions Reductions (MT)
1	Daytona/Yale Facility	22,046	85	1.65	8.90
2	Daytona/Yale Facility	21,093	81	1.58	8.52
3	Civic Plaza Garage	20,370	78	1.53	8.23
4	Daytona/Yale Facility	16,830	65	1.26	6.80
5	CASA	16,762	64	1.26	6.77
6	Daytona/Yale Facility	14,416	55	1.08	5.82
7	Daytona/Yale Facility	14,153	54	1.06	5.72
8	Daytona/Yale Facility	13,992	54	1.05	5.65
9	Daytona/Yale Facility	13,846	53	1.04	5.59
10	Civic Plaza Garage	13,576	52	1.02	5.48
Total				*11.27*	*67.48*

Publicly Accessible and Employee Charging Stations

Seventy-five responses were received to the Facility Manager survey (56 percent response rate). Most of the facilities with the highest expected visitation were included in the collected responses. We estimate 91.9 percent of annual visitors to all City facilities are to facilities where a facility manager provided site-specific information. This indicates that less than ten percent of the modeled demand is based on approximated visitation statistics.

In Scenario 1, under the one percent adoption rate, 24 percent of the facilities (n=32) are expected to have at least one electric vehicle present on any average open day. In Scenario 2, under the two percent adoption rate, 39 percent of facilities (n=52) are expected to have at least one electric vehicle present on an average open day. In Scenario 3, under the five percent adoption rate, 55 percent of facilities (n=73) are expected to have at least one electric vehicle present on an average open day (Appendix C).

Facilities with the highest simulated EV presence for all scenarios were the Albuquerque BioPark, City Hall, and Isotopes Stadium. Other facility types with relatively high expected EV presence include libraries, transit centers, senior centers, and community centers. Electric vehicle charging station recommendations were generated for facilities that are expected to have at least one EV present on an average business day (Appendices C and D). A total of seven DCFC stations are recommended under Scenario 1, a total of 10 under Scenario 2, and 43 under Scenario 3. Recommended investments in Level 2 Stations include 31 stations under Scenario 1, a total of 64 under Scenario 2, and 99 under Scenario 3 (Figure 3, Table 2).

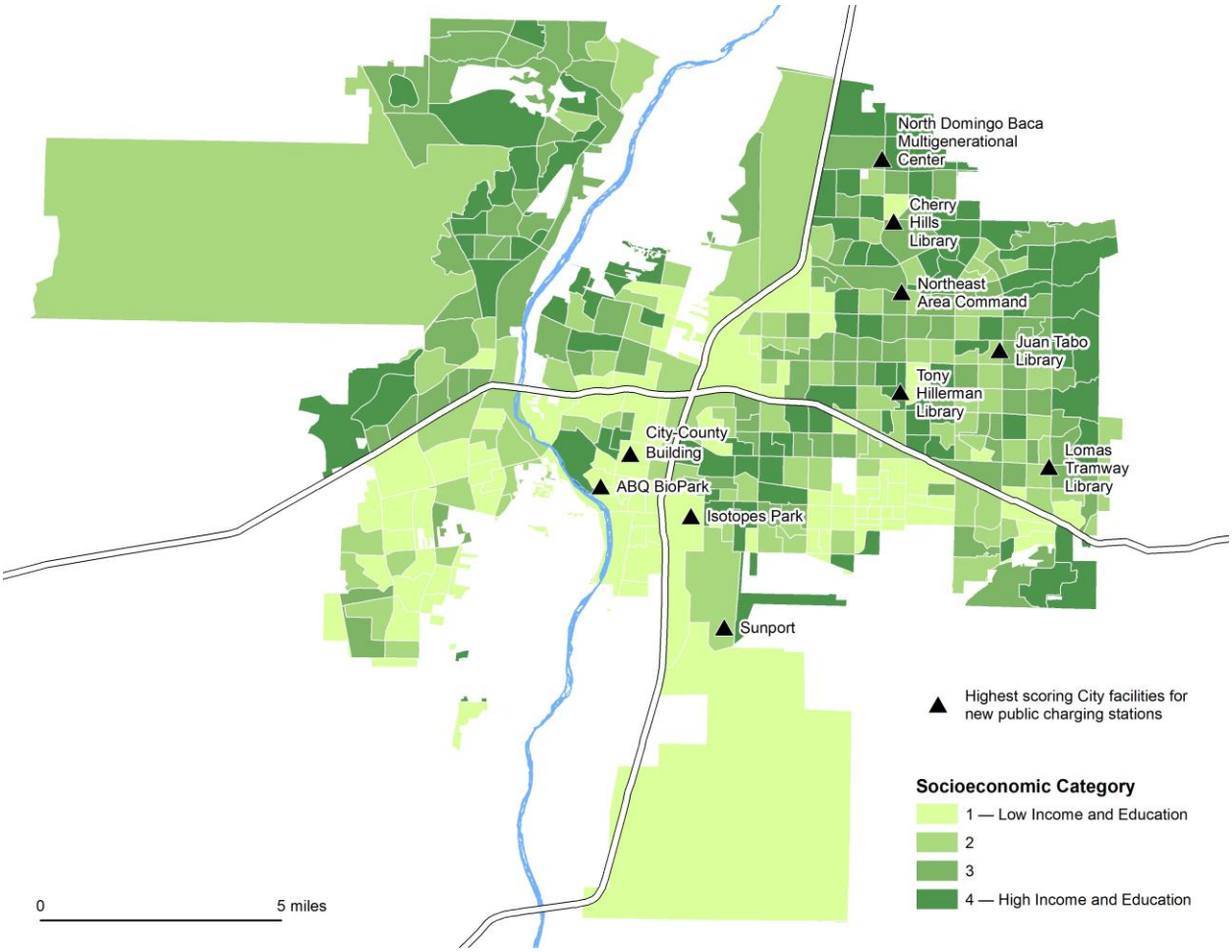

Figure 3. This map shows the top ten City facilities recommended for electric vehicle charging station construction for use by City employees and the general public. These facilities were recommended and ranked based on the simulated daily number of electric vehicles (EV) at the facility, estimated greenhouse gas emissions reductions, and equity factors such as families below the federal poverty level and educational attainment. Simulated EV presence was the highest weighted of these factors. Facilities with the highest simulated EV presence for all scenarios are the Albuquerque BioPark, City Hall, and Isotopes Stadium.

Table 2. This table shows the top ten City facilities recommended for electric vehicle charging station construction for use by City employees and the general public. These facilities were recommended and ranked based on the simulated daily number of electric vehicles (EV) at the facility, estimated greenhouse gas emissions reductions, and equity factors such as families below the federal poverty level and educational attainment. Simulated EV presence was the highest weighted of these factors. Facilities with the highest simulated EV presence for all scenarios are the Albuquerque BioPark, City Hall, and Isotopes Stadium. Emissions reductions for NOx (Nitrous Oxides) are reported in grams per year and CO_2 (carbon dioxide) are reported in metric tons of carbon dioxide per year.

Rank	Facility	Daily EVs @ 1%	Daily EVs @ 2%	Daily EVs @ 5%	NOx Emissions (g)	CO_2 Emissions (MT CO_2)	Socioeconomic Category
1	ABQ BioPark	17	34	85	14.4 – 71.9	28.1 – 140.4	4
2	City Hall	9	17	43	7.2 – 35.8	9.43 – 47.2	4
3	Isotopes Stadium	8	17	42	6.0 – 30.2	14.0 – 69.9	4
4	ABQ International Sunport	7	14	36	3.5 – 17.7	11.8 – 58.9	3
5	NE Area Command	3	7	17	2.7 – 13.4	3.2 – 16.0	1
6	Cherry Hills Library	3	6	15	2.5 – 12.6	4.9 – 24.5	2
7	N. Domingo Baca Multigenerational Center	3	6	14	2.4 – 12.1	4.1 – 24.5	2
8	Juan Tabo Library	2	5	12	1.9 – 9.7	2.7 – 13.6	3
9	Tony Hillerman Library	2	4	11	1.9 – 9.3	2.6 – 12.9	1
10	Lomas Tramway Library	2	4	11	1.8 – 9.2	2.6 – 12.8	3

Recommendations

For the fleet vehicle analysis, it is recommended that the City primarily invest in Level 2 charging infrastructure, as the majority of the fleet vehicles drive less than 50 miles on a daily basis. A full charge will last these vehicles a full day, and charging will largely occur overnight. In the public charging station scenario, Direct Current Fast Charging stations are recommended for facilities with 10 or more projected daily electric vehicles and average visitor residence time of 30 minutes or less. The City also has the opportunity to further support EV adoption through various policy and financial mechanisms.

Recommendation for Investment in Fleet Charging Stations

In general, most City of Albuquerque light duty fleet vehicles drive fewer than 50 miles daily and are expected to require Level 2 charging stations. Level 2 charging stations can provide up to 30 miles of charge in an hour, which is sufficient for the daily needs of 77 percent of all fleet vehicles currently in operation. Direct Current Fast Charging stations (DCFC, or Level 3) are only recommended for facilities that either have a high number of vehicles that are housed at the site or that have the highest daily miles traveled. Level 3 chargers are also significantly more expensive to install, and on average cost $30,000-$150,000 per unit (Table 3). Recommendations for charging station infrastructure were spread out to facilities throughout the city to ensure that range anxiety for City employees driving the vehicles is minimized.

Table 3. Comparison of power requirements, estimated charging times, and cost of Level 2 and DC Fast Charging stations (after Dong et al. 2014). Circuit currents reported in volts (V) and amps (A).

	Level 2 – Commercial	Level 3 – DC Fast Charger
Charging Circuit	240 V, 30 A	50 V, 200 A
Power (kW)	6	90
Time to Full Charge	~8 hours	30-60 minutes
Cost ($)	~ $2000	$30,000-150,000

Recommendation for Investment in Publicly Accessible Charging Stations

Charging station recommendations for public and employee use were largely influenced by visitation rate and residence time at the facility in addition to simulated EV presence in the three adoption rate scenarios. By far, the facilities with the most simulated EVs in each scenario were the Albuquerque BioPark, City Hall, and Isotopes Stadium. The BioPark is expected to have the greatest demand for DCFC stations in each scenario due to the magnitude of visitation it receives, and fewer DCFC stations were recommended for City Hall and Isotopes Stadium, as they are expected to receive around half the daily EVs comparatively. While the Sunport was just outside the top 10 facilities for new charging station infrastructure, it is expected to have high demand for Level 2 charging stations. In addition to the Level 2 chargers for Sunport passengers, we recommend placing a few DCFC stations at the Sunport's Cell Phone Lot to meet the expected demand from residents who wait in the lot for friends and family to arrive and for rideshare drivers that transport paying customers to and from the Sunport.

Electric vehicle use is known to help reduce emissions of common greenhouse gases, such as carbon dioxide and methane, as well as criteria pollutants such as Nitrous Oxides (NOx), volatile organic compounds (VOCs) and particulate matter (PM). In an analysis of Bernalillo County, widespread EV adoption led to significant reductions in VOCs and carbon monoxide, as well as NOx (Salisbury 2014). Reductions in these criteria pollutants and greenhouse gases will help Albuquerque to address air quality issues and can help improve public health. Light duty vehicles in Bernalillo County contribute 60 percent of the county's carbon monoxide emissions, 39 percent of the county's NOx emissions, and 31 percent of the county's VOC emissions (Salisbury 2014). By converting the City of Albuquerque's light duty fleet vehicles to electric vehicles, and by putting in additional EV charging stations to encourage City employees and residents to switch to EVs, Albuquerque can make significant strides towards being a city that is taking action to mitigate climate change and can set an example for other large cities in the Southwest.

Like in the Fleet Vehicle analysis, most locations recommended for investment in public stations for use by employees and the general public are for Level 2 chargers. These are less expensive to install than DCFC chargers and, if placed throughout the city, can satisfy the needs of most electric vehicle owners, and especially employees who may be at the facility for longer periods of time. Best practices for constructing charging stations at recommended facilities include constructing near existing electrical outlets, choosing areas that are well lit and have strong cell phone signals, and using a wall mount if constructing near a wall. Additionally, facilities should be near to public amenities such as malls or restaurants, have access to three phase power, be ADA compliant and be universally accessible to all EV models (Hall and Lutsey 2017, Svitak et al 2017).

EV owners in 2019 are largely middle-aged, affluent white males who charge at home (Appendix E; Hall and Lutsey 2017). Often, those who wish to purchase EVs do not live in single-family houses where they can build personal charging stations. To increase interest in EVs and equity in the availability of charging options, it is recommended that the City invest in charging infrastructure not only in the more affluent areas where EV owners generally live, but also in the areas with lower median incomes and where apartment and multi-family dwelling units are found.

Policies and Mechanisms for Increased EV Adoption

The top reasons that prevent residents from purchasing electric vehicles include range anxiety, lack of awareness and high vehicle costs (Coven 2018; GoEVCity 2018). Financial mechanisms are therefore an enticing way to encourage citizens to adopt EVs. At the state level, new income tax credits or rebates could be developed that would help subsidize the cost of a new electric vehicle and/or electric vehicle charging equipment (Frades 2014). Another major barrier to widespread electric vehicle adoption is the lack of available charging infrastructure for residents who live in multi-family housing. Residents in multi-family housing are largely unable to own home charging equipment, and if there are no charging options available to them in the workplace they are unlikely to consider owning EVs. To reduce this form of range anxiety, the City could amend building codes, such as the 2018 IECC codes, for all new multi-family housing to mandate wiring for EV charging and to allocate a set amount of parking spaces as EV charging spaces, so they are "EV ready" (Frommer 2018, Lubinsky et al 2012).

Based on interviews with EV charging station vendors and the responses to an Electric Vehicle Owners survey (Appendices E and F), one of the most important aspects of an EV charging station network is station maintenance and reliability. The most common complaint heard from the vendors active in New Mexico was encountering stations that were broken or frequently in need of repair (Appendix E). Malfunctioning stations only add to driver's range anxiety because the driver may not have enough charge to make it to the next available station if they are in an area without a fully developed EV charging station network. This is especially the case in urban environments (Svitak et al 2017). The City should require as a part of its contract with the chosen charging station vendor that maintenance occur at a set interval or that the vendor be responsive to malfunctioning stations within 24 hours. Stations should also be easily accessible for drivers and be in a visible location that is easy to find. One way to help with this is to create a page or tab on the City's 311 App specifically for publicly-available charging stations. Residents would also be able to post feedback on the page and alert the City to any stations requiring maintenance. It is critical for the City to continually seek feedback from users of the stations and be adaptive to any requests or needs of the drivers, as this will lead to increased trust between the City and drivers and in turn increased EV adoption city-wide. Finally, the City should create an extensive marketing plan to help promote the stations once they are built. Increased awareness of the stations' presence will expand interest in EVs and can lead to further EV adoption.

Conclusion

The City of Albuquerque has an opportunity to expand electric vehicle use, and reduce greenhouse gas emissions, by constructing charging stations for both its light duty vehicle fleet and for use by the public. As gas prices continue to increase and the price of EVs continues to fall, the cost of electric vehicle ownership will become increasingly affordable. Investment in charging infrastructure will be necessary to serve the growing number of EVs on the road. The City can play a proactive role in supporting existing EV owners and encouraging additional EV adoption by building additional charging infrastructure.

As the electricity generation sector moves away from fossil fuels and towards more renewable sources of energy, the transportation industry will quickly become the leading source of greenhouse gas emissions in New Mexico. Reducing transportation emissions is a critical component of the City's strategy to meet its climate goals. Electric vehicle use is known to reduce emissions of common greenhouse gases as well as criteria pollutants. Increased EV use will lead to improvements in the City's air quality.

Improved air quality will be beneficial to all who live in the City, especially for low income and at-risk populations. We recommend that the City invest in charging infrastructure not only in the more affluent areas where EV owners currently live, but also in the areas with a lower socioeconomic status and where apartment and multi-family dwelling units are found. If investments in fleet conversion and public infrastructure are made by the City, optimizing those investments based on the results of this analysis will maximize emissions reductions and EV adoption.

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Appendix A – COA Facility Manager Survey

These questions were asked in the Facility Manager survey sent out to all facility managers for the City of Albuquerque:

1. What are the facility's operating hours?
2. What parking options does the facility have?
3. If this facility has a parking lot or garage, how many spaces are available?
4. How many light duty City vehicles are parked at the facility when the vehicle is not in use?
5. How many monthly visitors does this facility receive?
6. How many annual visitors does this facility receive?
7. What percentage of visitors arrive at this facility in a personal vehicle?
8. How long does an average visitor spend at this facility?
9. Have you noticed electric vehicles or hybrid electric vehicles in use in the area around this facility?
10. How many full-time staff work at this facility?
11. How many part-time staff work at this facility?
12. What percentage of staff that work at this facility drive personal vehicles to work on a daily basis?
13. Please provide any additional comments you would like to share about this facility, visitation, staffing or electric vehicle use.

Full results of the facility manager survey are available online:
https://tnc.box.com/s/pdamcrer0469fk6m2xt03jh7b19rusaq

Appendix B – Charging Station Recommendations for Fleet Vehicles

Table B1. Recommendations are based on three scenarios: conversion of fleet vehicles with the top 25% of annual emissions, conversion of fleet vehicles with the top 50% of annual emissions, and conversion of fleet vehicles with the top 75% of annual emissions. Based on the number of fleet vehicles housed at city facilities in each scenario, as well as average daily mileage of the vehicles, electric vehicle charging infrastructure recommendations were developed. The table shows recommendations for the number of electric vehicle charging stations (EVCS), the type of electric vehicle charging station [Direct Current Fast-Charging (DCFC) or Level 2 (L2)], and the total number of charging plugs available for use by drivers.

		Top 25% Conversion Scenario			Top 50% Conversion Scenario			Top 75% Conversion Scenario		
Facility	**Total Fleet Vehicles**	**# of EVCS**	**Type of EVCS**	**# of Plugs**	**# of EVCS**	**Type of EVCS**	**# of Plugs**	**# of EVCS**	**Type of EVCS**	**# of Plugs**
ABQ BioPark	1	0	—	—	0	—	—	0	—	—
Acropolis Parking Garage	1	0	—	—	1	L2	1	1	L2	1
Airfield Maintenance	2	0	—	—	1	L2	1	1	L2	1
Animal Welfare	3	1	L2	1	1	L2	2	1	L2	2
AQ Westside	3	0	—	—	1	L2	1	1	L2	2
Balloon Fiesta Park	2	1	L2	1	1	L2	2	1	L2	2
Barelas Senior Center	6	0	—	—	1	L2	2	2	L2	4
CASA	2	1	L2	2	1	L2	1	1	L2	2
Child Development Center	1	0	—	—	0	—	—	0	—	—
Civic Center/Plaza Garage	38	3	L2	6	2; 5	DCFC; L2	4; 10	2; 8	DCFC; L2	4; 16
Compass Bank Lot	25	1	L2	1	3	L2	6	2; 5	DCFC; L2	4; 10
Convention Center Garage #1	27	3	L2	6	2; 5	DCFC; L2	4; 10	2; 6	DCFC; L2	4; 12
CREI/Admin	1	0	—	—	0	—	—	0	—	—
Cultural Services	1	0	—	—	0	—	—	1	L2	1
Daytona/Yale	40	2; 10	DCFC; L2	4; 2	4; 15	DCFC; L2	8; 30	4; 15	DCFC; L2	8; 30
Double Eagle Airport	1	0	—	—	0	—	—	1	L2	1
Facility Maintenance Yard	1	0	—	—	0	—	—	1	L2	1
Fleet	16	1	L2	2	2	L2	4	2; 3	DCFC; L2	4; 6
Heading Home Shelter	1	1	L2	1	1	L2	1	1	L2	1
Highland Senior Center	1	0	—	—	0	—	—	1	L2	1
Jerry Cline Tennis Center	1	0	—	—	0	—	—	1	L2	1
Ladera Golf Course	1	0	—	—	0	—	—	1	L2	1
Los Altos Golf Course	1	0	—	—	0	—	—	0	—	—
Los Altos Pool	1	0	—	—	1	L2	1	1	L2	1
Montessa Park	5	1	L2	1	1	L2	2	1	L2	2
North Domingo Baca Multigenerational Center	1	0	—	—	0	—	—	0	—	—
Open Space Visitors Center	6	1	L2	1	1	L2	2	2	L2	4
Pino Yards	37	1; 1	DCFC; L2	2; 2	2; 5	DCFC; L2	4; 10	3; 12	DCFC; L2	6; 24
Plaza del Sol	5	0	—	—	1	L2	2	2	L2	4
Sierra Vista Tennis Center	1	0	—	—	1	L2	1	1	L2	1
Solid Waste Edith	2	0	—	—	0	—	—	0	—	—
Sunport	12	1	L2	1	2	L2	4	3	L2	6
Valle del Norte Community Center	1	0	—	—	1	L2	1	1	L2	1
VPMD/Valley Pool	1	0	—	—	0	—	—	0	—	—
West Mesa Community Center	2	0	—	—	1	L2	1	1	L2	2
West Mesa Pool	2	0	—	—	0	—	—	1	L2	1

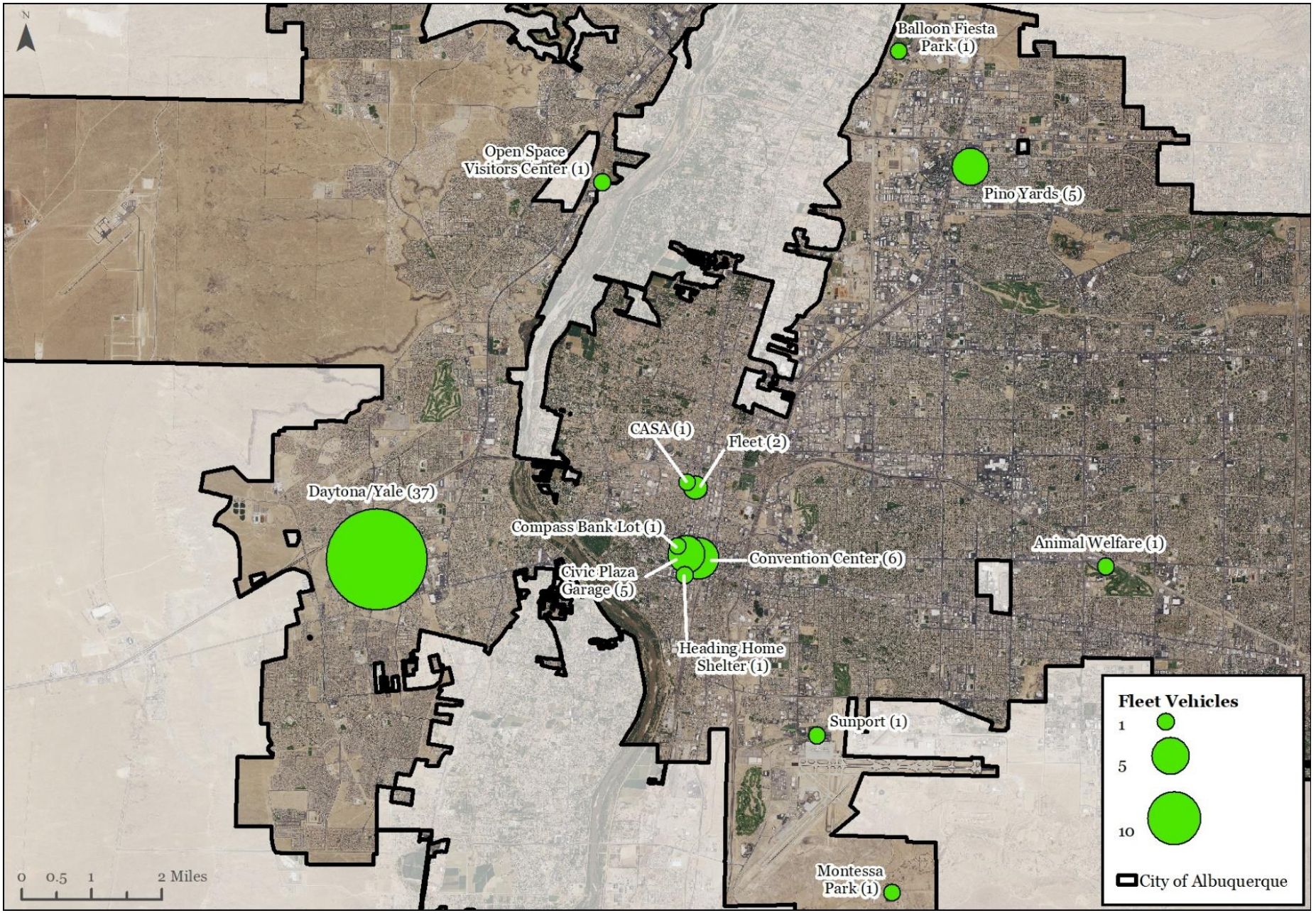

Figure B1. This map depicts the City facilities that house the fleet vehicles that fall within the top 25 percent of overall annual emissions. The symbols show the number of fleet vehicles at the facility in the top 25 percent and is also shown by the number in parentheses. Locations with the largest concentration of fleet vehicles in this scenario include the Daytona/Yale Facility, the Convention Center parking garage, the Civic Plaza garage and the Pino Yards.

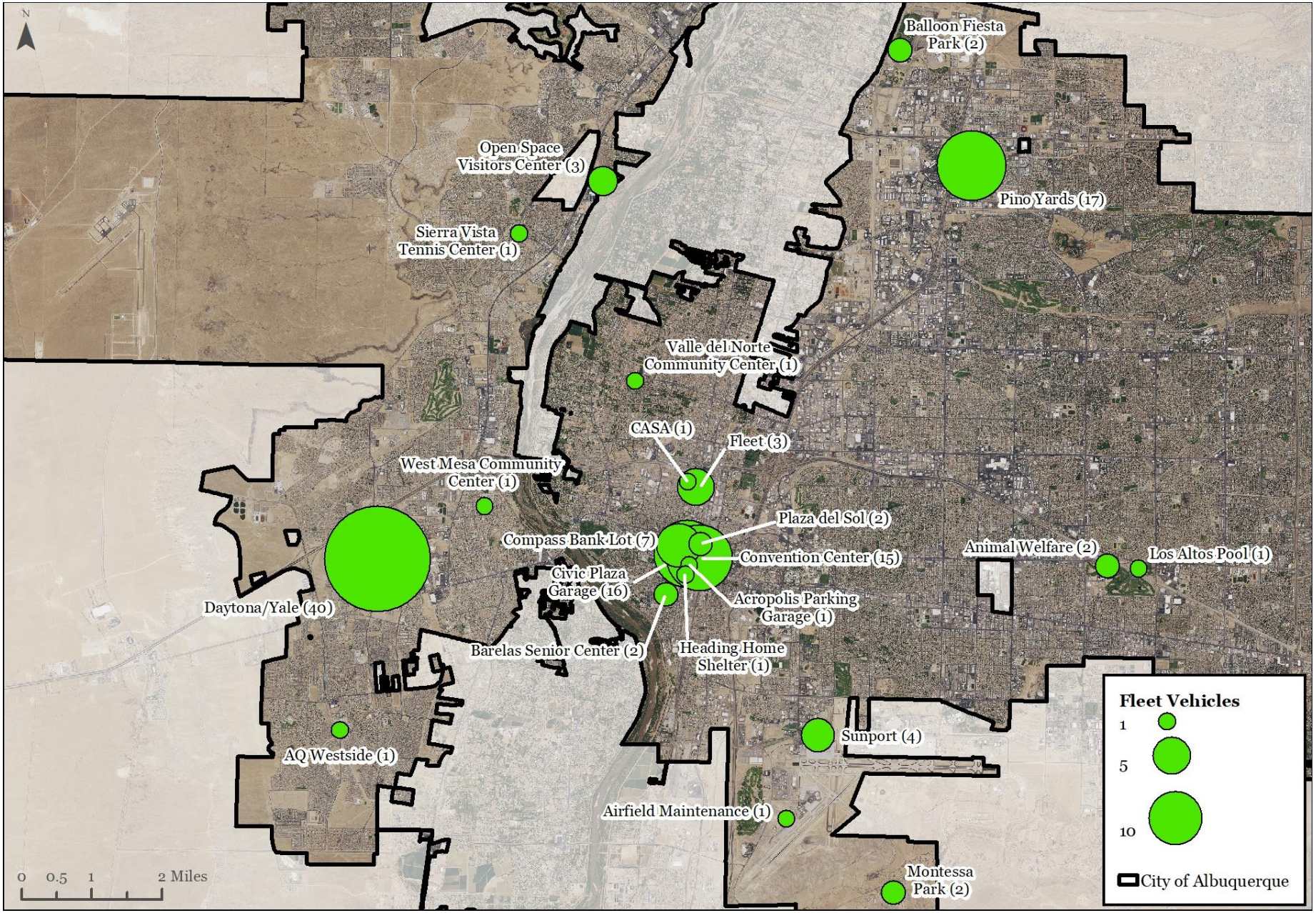

Figure B2. This map depicts the City facilities that house the fleet vehicles that fall within the top 50 percent of overall annual emissions. The symbols show the number of fleet vehicles at the facility in the top 50 percent and is also shown by the number in parentheses. Locations with the largest concentration of fleet vehicles in this scenario include Daytona/Yale Facility, the Convention Center parking garage, the Civic Plaza garage and the Pino Yards.

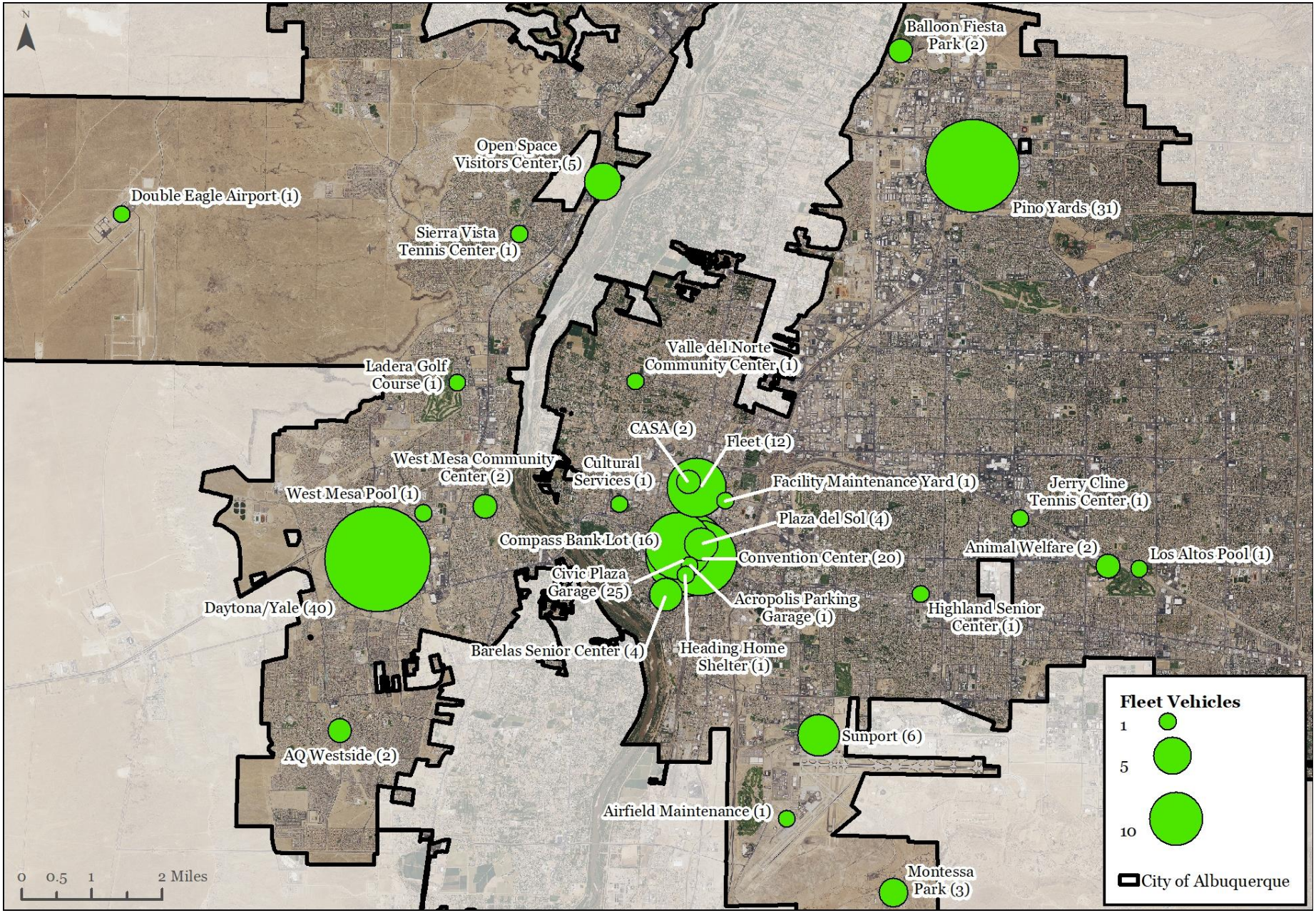

Figure B3. This map depicts the City facilities that house the fleet vehicles that fall within the top 75 percent of overall annual emissions. The symbols show the number of fleet vehicles at the facility in the top 75 percent and is also shown by the number in parentheses. Locations with the largest concentration of fleet vehicles in this scenario include Daytona/Yale Facility, the Civic Plaza garage and the Pino Yards.

Appendix C – Public Charging Station Recommendations for Employees and Visitors

Table C1. Recommendations are based on three scenarios: an Electric Vehicle (EV) adoption rate of one percent (one percent of all new automobile sales in New Mexico are all-electric vehicles), an EV adoption rate of two percent, and an EV adoption rate of five percent. Based on the simulated daily number of EVs at each facility, as well as projected emissions reductions and an equity score based on families below the federal poverty level and educational attainment, electric vehicle charging station recommendations were created. This table shows simulated daily EVs at each facility for the three scenarios, recommended number of Direct Current Fast Charging (DCFC) stations for each facility for the three scenarios, and recommended number of Level 2 (L2) charging stations for each facility for the three scenarios.

Facility Name	Total EVs Scenario 1	Total EVs Scenario 2	Total EVs Scenario 3	DCFC Scenario 1	DCFC Scenario 2	DCFC Scenario 3	L2 Scenario 1	L2 Scenario 2	L2 Scenario 3
4th Street Yards	1	1	3	0	0	0	0	0	1
5th Area Command	1	2	5	0	0	0	0	0	1
Academy	1	2	5	0	0	0	1	1	1
ABQ BioPark	17	34	85	2	3	6	2	3	4
Alamosa Community Center	2	4	10	0	0	1	1	1	1
Alamosa Library	0	1	2	0	0	0	0	0	1
Albuquerque Museum	2	4	10	0	0	1	1	2	2
Alvarado Transit Center	1	1	3	0	0	0	0	0	1
Anderson Abruzzo Albuquerque International Balloon Museum	2	4	10	0	0	1	1	2	2
APD Crime Lab	0	0	0	0	0	0	0	0	0
APD Firing Range	1	1	3	0	0	0	0	0	1
APD/Fire Station 20	0	0	1	0	0	0	0	0	0
Barelas Community Center	0	1	1	0	0	0	0	0	0
Barelas Senior Center	2	3	8	0	0	1	1	1	1
Barelas Daycare	0	0	1	0	0	0	0	0	0
Bear Canyon Senior Center	1	3	7	0	0	1	1	1	1
Broadway Sub	0	0	0	0	0	0	0	0	0
Carlos Rey Daycare	0	0	1	0	0	0	0	0	0
Central & Unser Library	4	8	21	1	2	3	1	2	3
Central & Unser Transit Center	1	1	3	0	0	0	0	0	1
Cesar Chavez Community Center	1	1	3	0	0	0	0	0	1
Cherry Hills Library	3	6	15	0	0	1	1	2	2
Child Development	0	0	1	0	0	0	0	0	0
City Hall	9	17	43	2	2	4	2	3	4
City of Albuquerque Records Center	0	0	0	0	0	0	0	0	0
Cottonwood Sub	0	0	0	0	0	0	0	0	0
CREI/AAA Admin Offices	0	0	1	0	0	0	0	0	0
Daytona Transit	2	4	10	0	0	1	1	2	2
Daytona Transit Facility	3	7	17	1	1	2	1	2	3
Dennis Chavez Community Center	0	1	1	0	0	0	0	0	0
Eagle Rock Administrative Building	0	0	0	0	0	0	0	0	0
East Animal Control	1	1	3	0	0	0	0	0	1
East Central Health and Social Service Center	0	0	0	0	0	0	0	0	0
Emissions	1	1	3	0	0	0	0	0	1
Erna Fergusson Library	4	8	19	1	1	2	1	2	3
Ernie Pyle Library	1	1	3	0	0	0	0	0	1

Table C1 continued **Facility Name**	**Total EVs Scenario 1**	**Total EVs Scenario 2**	**Total EVs Scenario 3**	**DCFC Scenario 1**	**DCFC Scenario 2**	**DCFC Scenario 3**	**L2 Scenario 1**	**L2 Scenario 2**	**L2 Scenario 3**
Fire (Main)	0	1	2	0	0	0	0	0	0
Fire Station 1	0	0	1	0	0	0	0	0	0
Fire Station 10	0	0	1	0	0	0	0	0	0
Fire Station 11	0	0	1	0	0	0	0	0	0
Fire Station 12	0	0	1	0	0	0	0	0	0
Fire Station 13	0	0	1	0	0	0	0	0	0
Fire Station 14	0	0	1	0	0	0	0	0	0
Fire Station 15	0	0	1	0	0	0	0	0	0
Fire Station 16	0	0	1	0	0	0	0	0	0
Fire Station 17	0	0	1	0	0	0	0	0	0
Fire Station 18	0	0	1	0	0	0	0	0	0
Fire Station 19	0	0	1	0	0	0	0	0	0
Fire Station 2	0	0	1	0	0	0	0	0	0
Fire Station 21	0	0	1	0	0	0	0	0	0
Fire Station 27	0	0	1	0	0	0	0	0	0
Fire Station 29	0	0	1	0	0	0	0	0	0
Fire Station 3	0	0	1	0	0	0	0	0	0
Fire Station 4	0	0	1	0	0	0	0	0	0
Fire Station 5	0	0	1	0	0	0	0	0	0
Fire Station 6	0	0	1	0	0	0	0	0	0
Fire Station 7	0	0	1	0	0	0	0	0	0
Fire Station 8	0	0	1	0	0	0	0	0	0
Fire Station 9	0	0	1	0	0	0	0	0	0
Foothills Area Command	1	2	5	0	0	0	0	0	1
Gerald Cline Sub	0	0	0	0	0	0	0	0	0
Heights Community Center	0	0	0	0	0	0	0	0	0
Herman Sanchez Community Center	0	0	1	0	0	0	0	0	0
Highland Senior Center	1	3	7	0	0	1	1	1	1
Holiday Park Community Center	1	1	3	0	0	0	0	0	1
Isotopes Stadium	8	17	42	1	2	4	2	3	4
Jack Candelaria Community Center	0	1	2	0	0	0	0	0	0
Jeanne Bellamah Community Center	0	1	2	0	0	0	0	0	0
Joan Jones Community Center	0	0	0	0	0	0	0	0	0
John Carrillo Sub	0	0	0	0	0	0	0	0	0
John Marshall Health and Social Service Center	0	0	0	0	0	0	0	0	0
Johnny Tapia Community Center @ Wells Park	0	0	1	0	0	0	0	0	0
Juan Tabo Library	2	5	12	0	0	1	1	2	2
KiMo Theatre	0	0	0	0	0	0	0	0	0
Loma Linda Community Center	0	0	1	0	0	0	0	0	0
Lomas Tramway Library	2	4	11	0	0	1	1	2	2
Los Duranes Community Center	0	0	1	0	0	0	0	0	0
Los Griegos Health and Social Services Center	0	0	0	0	0	0	0	0	0
Los Griegos Library	1	2	6	0	0	1	1	1	1
Los Volcanes Senior Center	2	5	12	0	0	1	1	2	2
Los Volcanes Sports & Fitness Center	0	0	1	0	0	0	0	0	0
Main Law Enforcement Center	4	8	21	1	2	3	1	2	3
Main Library	3	5	13	0	0	1	1	2	2
Manzano Mesa Senior Center	1	1	3	0	0	0	0	0	1

Table C1 continued **Facility Name**	**Total EVs Scenario 1**	**Total EVs Scenario 2**	**Total EVs Scenario 3**	**DCFC Scenario 1**	**DCFC Scenario 2**	**DCFC Scenario 3**	**L2 Scenario 1**	**L2 Scenario 2**	**L2 Scenario 3**
McKinley Community Center	0	0	1	0	0	0	0	0	0
Mesa Verde Community Center	0	0	0	0	0	0	0	0	0
Montgomery Sub	0	0	0	0	0	0	0	0	0
North Domingo Baca Multigenerational Center	3	6	14	0	0	1	1	2	2
North Valley Senior Center	0	1	1	0	0	0	0	0	0
Northeast Area Command	3	7	17	1	1	2	1	2	3
Northwest Area Command	0	1	2	0	0	0	0	0	0
Northwest Transit Center	0	1	2	0	0	0	0	0	1
Old Town Substation	0	0	0	0	0	0	0	0	0
Open Space	0	0	1	0	0	0	0	0	0
Open Space Visitors Center	0	0	0	0	0	0	0	0	0
Palo Duro Fitness	2	4	10	0	0	1	1	2	2
Palo Duro Senior Center	0	1	2	0	0	0	0	0	1
Park and Ride	1	1	3	0	0	0	0	0	1
Phil Chacon Sub	0	0	0	0	0	0	0	0	0
Pino Yards	1	2	5	0	0	0	1	1	1
Plaza del Sol	3	6	15	1	1	2	1	2	3
San Pablo Clinic	0	0	0	0	0	0	0	0	0
San Pedro Library	1	3	6	0	0	1	1	1	1
Scientific Evidence Division	1	2	6	0	0	0	1	1	1
Senior Affairs	0	0	0	0	0	0	0	0	0
Singing Arrow Community Center	0	0	0	0	0	0	0	0	0
Snow Park Community Center	0	0	0	0	0	0	0	0	0
Solid Waste Edith	0	1	2	0	0	0	0	0	0
South Broadway Cultural Center	1	2	4	0	0	0	0	0	1
South Broadway Library	1	2	4	0	0	0	0	0	1
Southeast Area Command	1	2	4	0	0	0	0	0	1
Southwest Area Command	1	2	4	0	0	0	0	0	1
Special Collections Library	0	1	2	0	0	0	0	0	0
Special Operations Division	0	1	2	0	0	0	0	0	0
Storm/Drain Maintenance Shop	0	0	0	0	0	0	0	0	0
Street Sat #2	0	0	0	0	0	0	0	0	0
Sunport	7	14	36	1	2	3	2	3	4
Taylor Ranch Community Center	1	1	3	0	0	0	0	0	1
Taylor Ranch Library	2	4	10	0	0	1	1	1	1
Thomas Bell Community Center	0	0	0	0	0	0	0	0	0
Tony Hillerman Library	2	4	11	0	0	1	1	2	2
Triangle Sub	0	0	0	0	0	0	0	0	0
Trumbull Daycare	0	0	1	0	0	0	0	0	0
Uptown Transit Center	2	3	8	0	0	1	1	1	1
Valle del Norte Community Center	0	0	1	0	0	0	0	0	0
Valley Area Command	1	1	3	0	0	0	0	0	1
West Animal Control	1	1	3	0	0	0	0	0	1
West Mesa Community Center	0	1	1	0	0	0	0	0	0
West Trailer/Tech	0	0	0	0	0	0	0	0	0
Westgate Community Center	0	0	1	0	0	0	0	0	0
Westgate Library	0	1	2	0	0	0	0	0	0
Whittier Community Center	0	0	0	0	0	0	0	0	0
Yale Transit	1	2	6	0	0	0	1	1	1

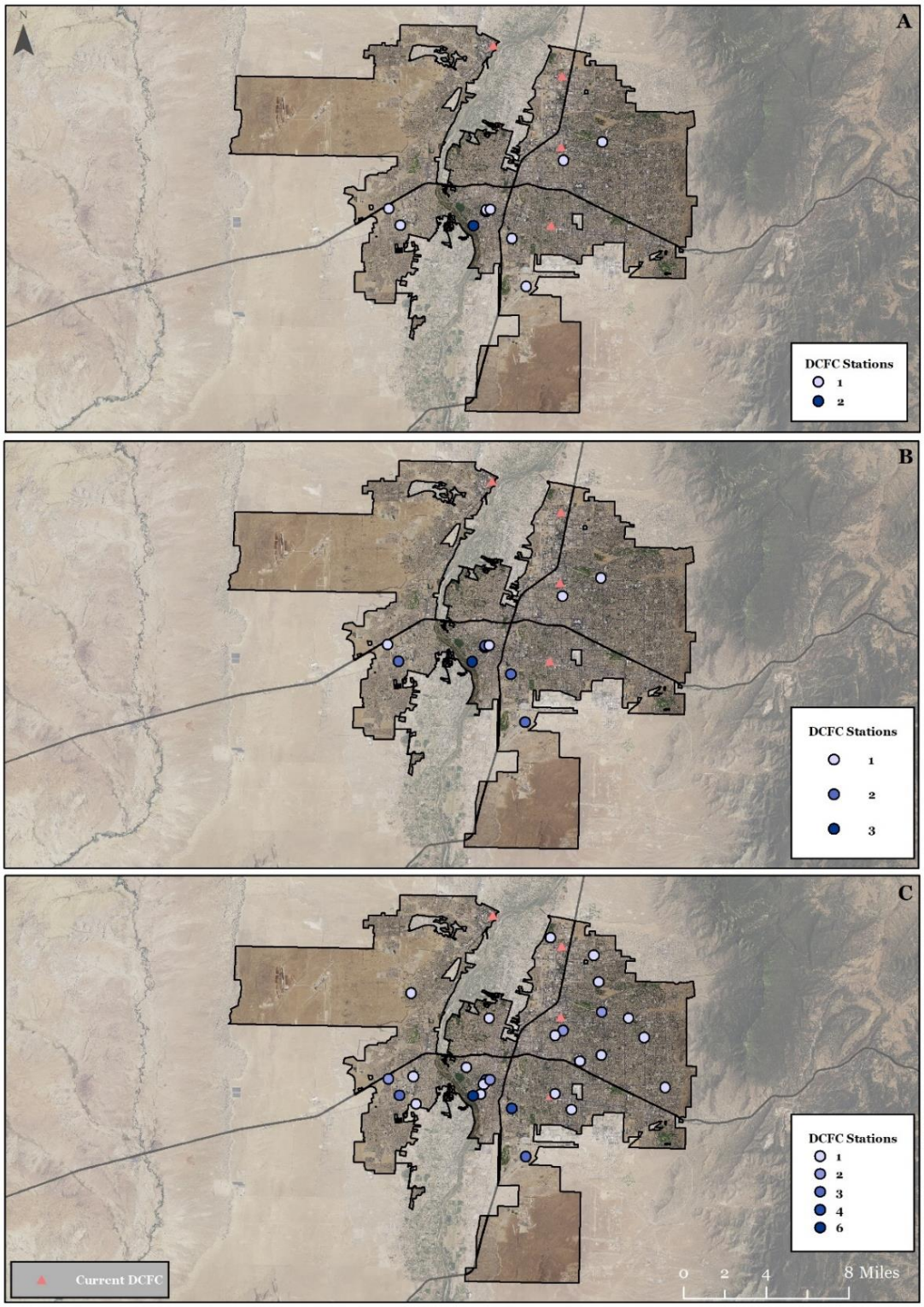

Figure C1. This map shows the current location of Direct Current Fast Charging (DCFC) stations in pink, as well as recommended additional DCFC stations to be placed at City facilities. Each map represents one of the three electric vehicle (EV) adoption rate scenarios: one percent of all new vehicle purchases (Map A), two percent of all new vehicle purchases (Map B), and five percent of all new vehicle purchases (Map C). The darker the blue color of the suggested additional charging stations indicates higher number of DCFC stations recommended at that City facility, which corresponds strongly with simulated daily presence of EVs.

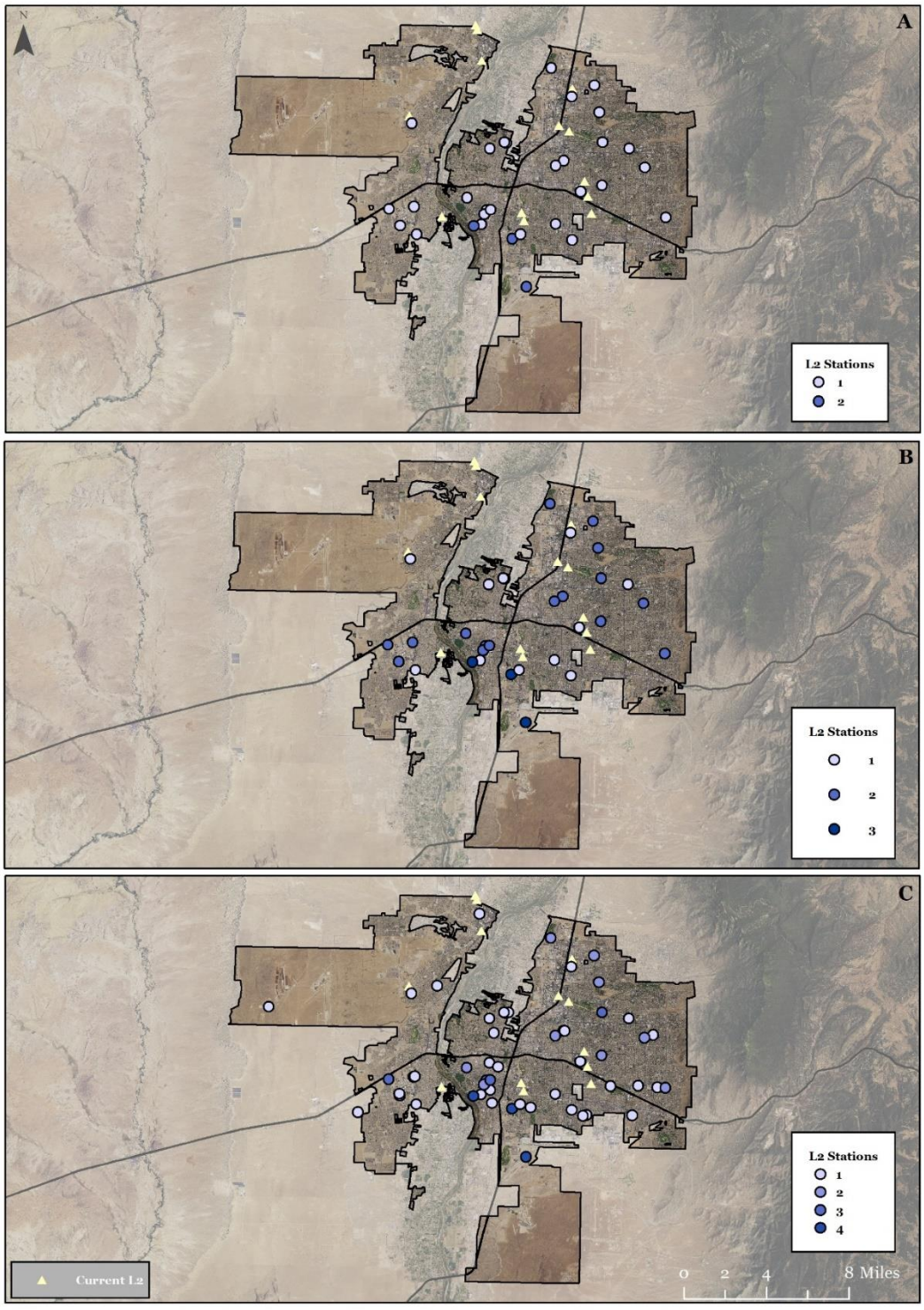

Figure C2. This map shows the current location of Level 2 (L2) stations in yellow, as well as recommended additional L2 stations to be placed at City facilities. Each map represents one of the three electric vehicle (EV) adoption rate scenarios: one percent of all new vehicle purchases (Map A), two percent of all new vehicle purchases (Map B), and five percent of all new vehicle purchases (Map C). The darker the blue color of the suggested additional charging stations indicates higher number of L2 stations recommended at that City facility, which corresponds strongly with simulated daily presence of EVs.

Appendix D – CABQ Facilities Expected Daily EV Visits

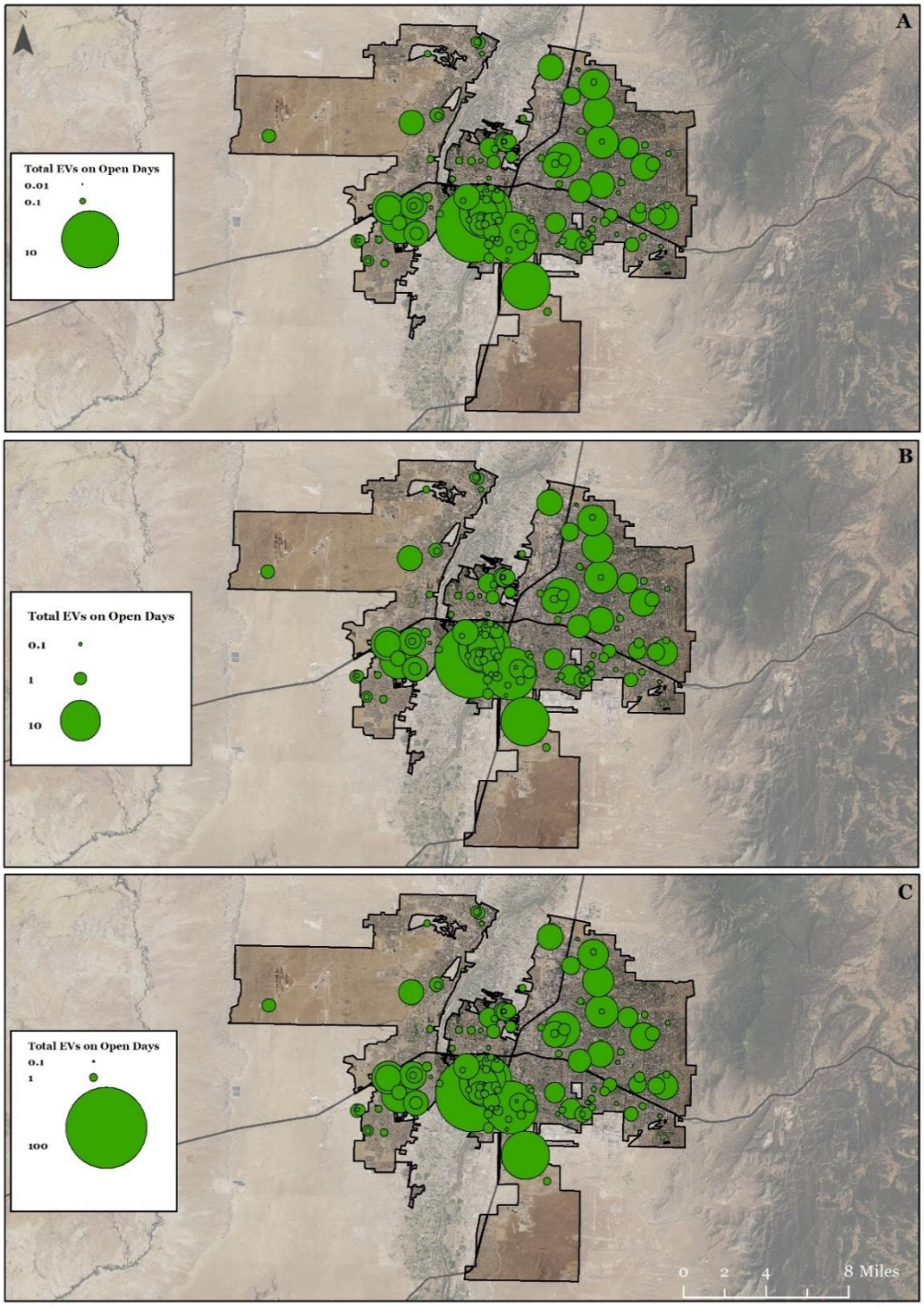

Figure D1. This map displays the number of electric vehicles (EVs) that are simulated to be present at City facilities based on three EV adoption rate scenarios (see Equation 1). The size of the green dot corresponds to the simulated number of EVs at each facility, with the larger dots indicating facilities with higher simulated EV presence. Map A represents the one percent EV adoption rate scenario, Map B represents the two percent EV adoption rate scenario, and Map C represents the five percent EV adoption rate scenario. In all EV adoption rate scenarios the facilities with the highest simulated EV presence are the Albuquerque BioPark, City Hall, and Isotopes Stadium.

Appendix E — Summary of Interviews with EVSE Vendors

Summary

- Three vendors of EV charging infrastructure that are active in New Mexico were surveyed to identify best practices for siting additional charging infrastructure.
- Business models are different for each vendor, though common trends emerged with demand for charging as a function of:
    - traffic volume
    - parking dwell time
    - EV prevalence

Introduction

To ensure the EVSE siting optimization analysis would be useful to EVSE vendors, interviews were sought with vendors currently working in Albuquerque. The critique and insights offered by the EVSE vendors were used to ensure the scientifically rigorous optimization analysis would also satisfy real-world information needs.

Methods

A comprehensive list of EVSE vendors currently working in the Southwestern US was developed by regional experts and supplemented with internet searches. EVGo, ChargePoint, and Go-Station were contacted with interview requests. Interviews were held by phone in April 2019. A standard set of questions was sent to each vendor prior to the interview and then used to structure the interview (Table 1).

Table 1. Questions asked to each EVSE vendor.

#	Question
1	What criteria do you use when deciding to place a charging station? Do you weight those criteria equally?
2	What do your customers look for in public charging station infrastructure?
3	What are the options for being a universal charger? (Using one station to charge any EV make/model)

Interviews drifted from the standard questions, but consistent information was gathered during each interview. The underlying business models and maturity of each vendor tilted the conversation in different ways. Individual responses are not reported but are instead described in aggregate.

Results

While most charging occurs at home, the interviews focused primarily on workplace and public charging stations. All vendors indicated that demand for EVSE usually directed the deployment of EVSE. High-traffic areas are usually preferred sites for EVSE deployment for public charging. Fleet conversion typically dictates the siting of EVSE because fleet vehicles typically can be exclusively charged with an L2 charger in the location where they are parked when not in use.

Dwell time was identified by all vendors as a significant factor when determining the demand for Level 2 (L2) or Direct Current Fast Charging (DCFC). Areas with dwell times shorter than 30 minutes are typically not considered for EVSE deployment. Areas with dwell times greater than 30

minutes are typically candidates for DCFC chargers. Areas with dwell times greater than 2 hours are candidates for L2 chargers.

Rideshare drivers drive many more miles and were discussed as a target group for electric vehicle (EV) adoption. Areas where rideshare drivers congregate and wait for passengers such as airport cell-phone lots were suggested as high priority places for DCFC EVSE deployment.

Different business models require different siting criteria. When retail facilities subsidize charging to attract customers, customer draw is the primary concern. When charging stations are intended to increase EV adoption, visibility is the primary factor. If revenue is to be generated by the charging station, demand is the primary siting constraint. Currently demand is highest in higher-income areas where early adopters have purchased luxury and other high-end Battery Electric Vehicles.

Reliability and convenience were described as the primary features EV drivers look for when selecting a charging station. Reliability, or station uptime, is important for developing trust in drivers that the station will be available when a charge is needed. Convenience was typically described as having stations in the places where drivers are already parking and spending time.

All vendors interviewed support both the CHAdeMO and Combined Charging System (CCS) standard plugs. Proprietary plugs typically offer adapters for these two common standard plugs.

Appendix F — Electric Vehicle Ownership Survey Results

Summary

- Albuquerque residents were surveyed about EV ownership and charging infrastructure.
- The informal online survey was completed by over 300 people, most in support of expanding investment in EV charging infrastructure.
- Downtown, Nob Hill, and Uptown, were the most frequently mentioned neighborhoods when asked where additional charging infrastructure would be most useful.
- Malls and shopping centers, parks, grocery stores, and parking structures were the most frequently mentioned types of places where additional charging infrastructure would be most useful.

Survey Design, Distribution, and Response

This survey was intended to be an informal study of resident views of electric vehicles (EVs) and a broad focus-group style review of resident desires for future EV charging infrastructure deployment. A focus group of 10 to 20 existing EV owners was initially planned. Because not all residents could participate in a focus group, a survey format was selected to expand the population that would be able to participate.

Through the survey we hoped to identify the concerns and needs of residents that own EVs, and document concerns and barriers to ownership for residents that do not own an EV. A short 12 question survey with logic automatically guiding respondents to the next question based on previous answers was prepared (Table 1).

Table 1. Questions asked in the EV survey. Questions 10 and 12 are identical though question 10 was answered by EV owners and people that foresee themselves owning an EV in the future. Question 12 was answered by people that do not own an EV and do not foresee themselves owning one in the future.

#	Question
1	Do you own an electric vehicle?
2	What type of electric vehicle do you own?
3	What make/model of Plug-In Hybrid Electric Vehicle do you own?
4	What make/model of All-Electric Vehicle do you own?
5	Where do you charge your vehicle?
6	How do you locate a public charging station if you need to use one? (ex. websites, apps, word of mouth etc.)
7	Do you foresee yourself purchasing an electric vehicle in the future?
8	Where would you like to see public charging infrastructure?
9	Would you be willing to pay to use public charging infrastructure?
10	Please provide any additional comments you would like to share about electric vehicles.
11	What is preventing you from purchasing an electric vehicle?
12	Please provide any additional comments you would like to share about electric vehicles.

The survey was available online for thirty days in April and May 2019. The survey became publicly accessible on April 19 and was closed to further responses on May 18. The survey was publicized through posts on social media accounts maintained by The Nature Conservancy and the City of Albuquerque that were amplified by local news reports and community email lists.

During the four weeks that the survey was available online, 310 responses were collected (Figure 1). Because no information about neighborhood, socioeconomic status, or other respondent

characteristics were collected, it is difficult to determine if the surveyed population is representative of the broader community. Given the survey design, it should not be assumed that the responses are representative of the broader community.

Because this survey was intended to be an informal focus-group style study, no personal identifying information was collected. The survey was publicized locally, but no verification that respondents were residents of Albuquerque was conducted so some responses may be from outside the Albuquerque metropolitan area. The volume of responses to the survey that were received was unexcepted. In the future, more rigorous survey methods would allow broader use of the data.

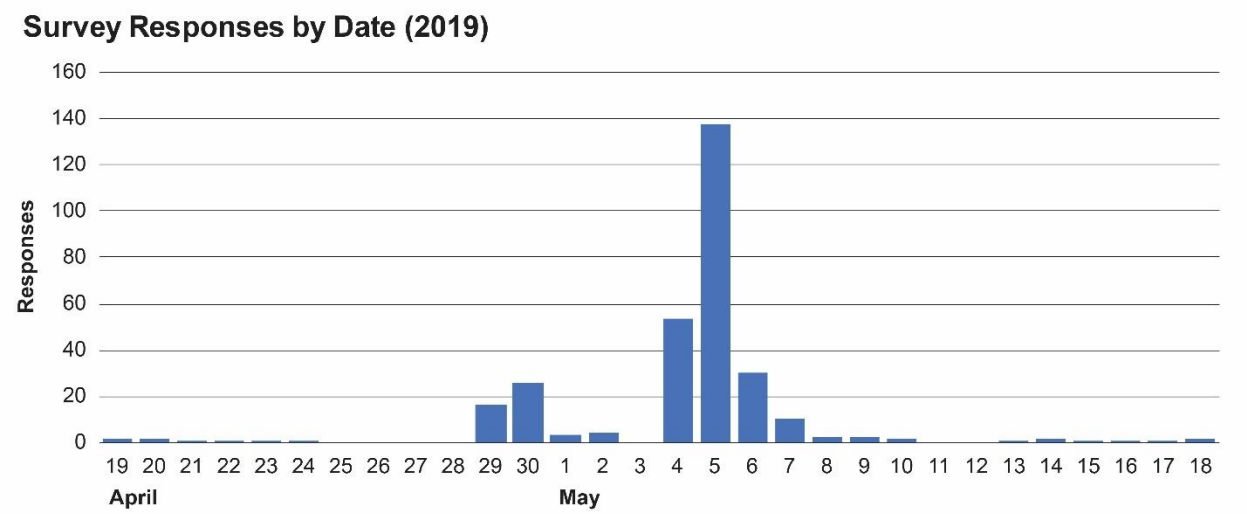

Figure 1. Survey responses by date. The CABQ Twitter account posted a link to the survey April 29. Television station KRQE also posted a link to the survey on their website on the 29th. It appears that the survey received additional awareness beginning May 4th, though the source of this increased traffic is unknown.

Many of the survey questions were open-ended and allowed unique responses. In order to aggregate and summarize the responses, some datasets were manually interpreted and reclassified to consistent terminology. For example, Toyota Prius and Prius were considered to be the same response. Raw responses without any reclassification are available upon request.

Survey Results

Despite the limitations of the survey methodology, the results provide an aggregation of resident concerns and desires for EV charging infrastructure. The survey results are summarized in three sections: EV Ownership, EV Charging, and Comments.

EV Ownership

Of survey respondents, 44.8 percent own an EV and 97.1 percent either own an EV or foresee themselves purchasing one (Figure 2). Of the respondents that own an EV, 25.9 percent own a plug-in hybrid EV and 74.1 percent own an all-electric EV.

Of the plug-in hybrid owners, 82 percent own a vehicle manufactured by Chevrolet, Ford, Tesla, or Toyota (Figure 3 Q3). Tesla does not manufacture a plug-in hybrid, so it is likely these owners misclassified the type of vehicle they own. Of all-electric vehicle owners, nearly 50 percent own vehicles manufactured by Tesla (Figure 3 Q4). The four most common all-electric vehicle manufacturers account for 87percent of all-electric vehicles reported in this survey.

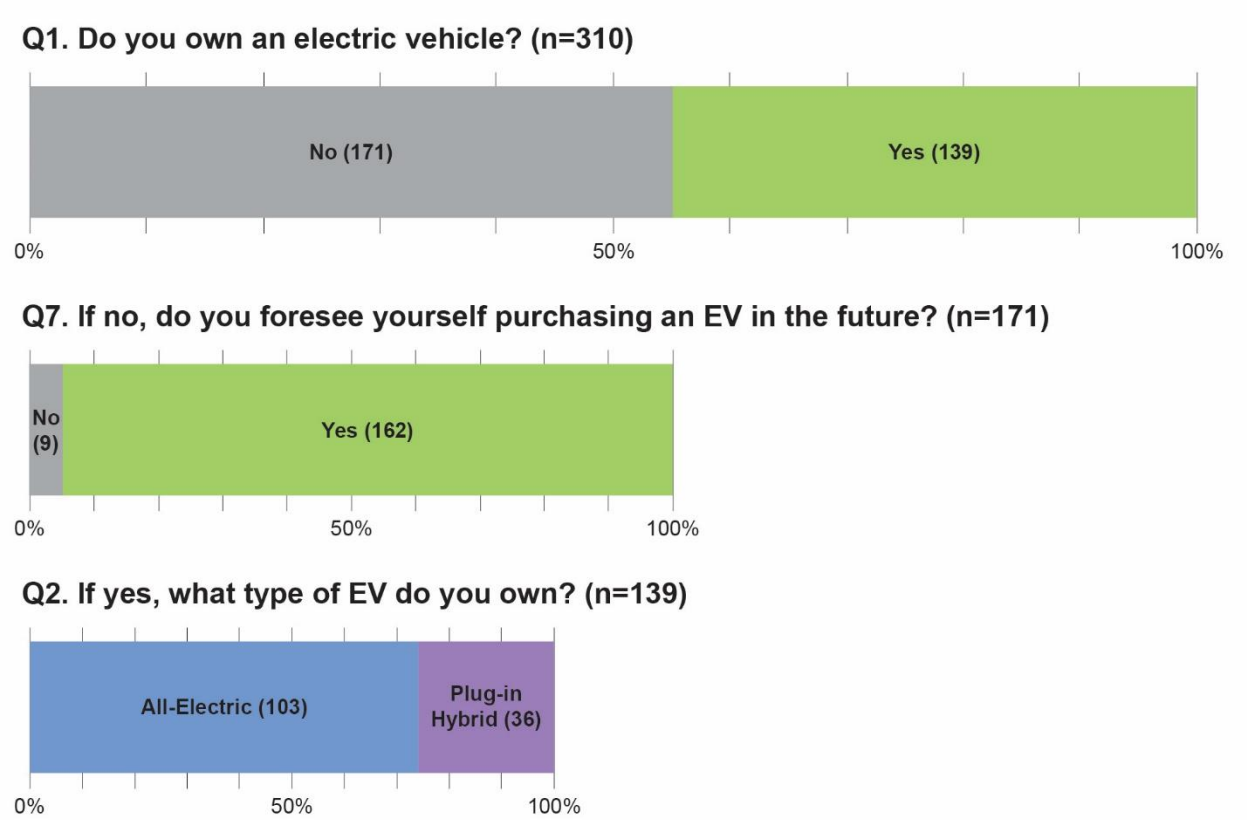

Figure 2. Of the 310 survey respondents, 97.1 percent own an EV or foresee themselves purchasing one. Electric vehicle owners comprise 44.8 percent of respondents, and of those EV owners 25.9 percent of them own plug-in hybrid vehicles and 74.1 percent own all-electric vehicles. Several respondents indicated they owned multiple EVs but could only indicate one EV in the survey.

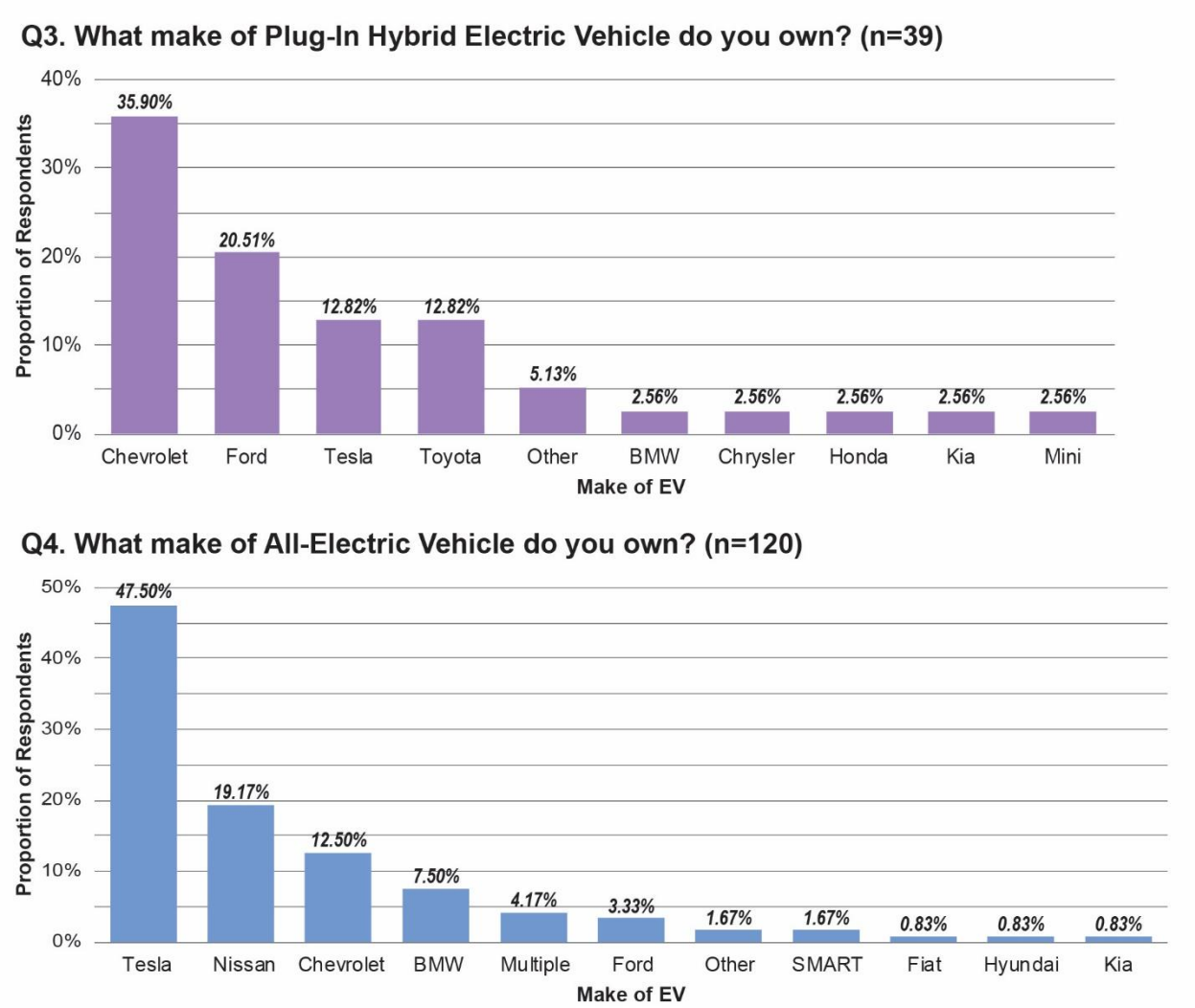

Figure 3. EV owners were asked about the make and model of their vehicles. The "Other" category includes hobby-built vehicles and responses where the make could not be identified. The "Multiple" category is used for respondents that indicated they owned multiple EVs without indicating the make and model.

EV Charging

Consistent with expectations (Idaho National Laboratory 2015), most EV owners charge only at home and around 10 percent of respondents charge at public charging stations (Figure 4 Q5). Workplace charging is not as common as expected, though lack of charging infrastructure may limit opportunities to charge at work. Shorter commutes may decrease demand for charging at work.

Most EV owners use phone applications (apps) to find charging stations (Figure 4 Q6). Internet sites and in-vehicle navigation systems are also frequently used. Over 6 percent of respondents charge exclusively at home and have never looked for public charging stations.

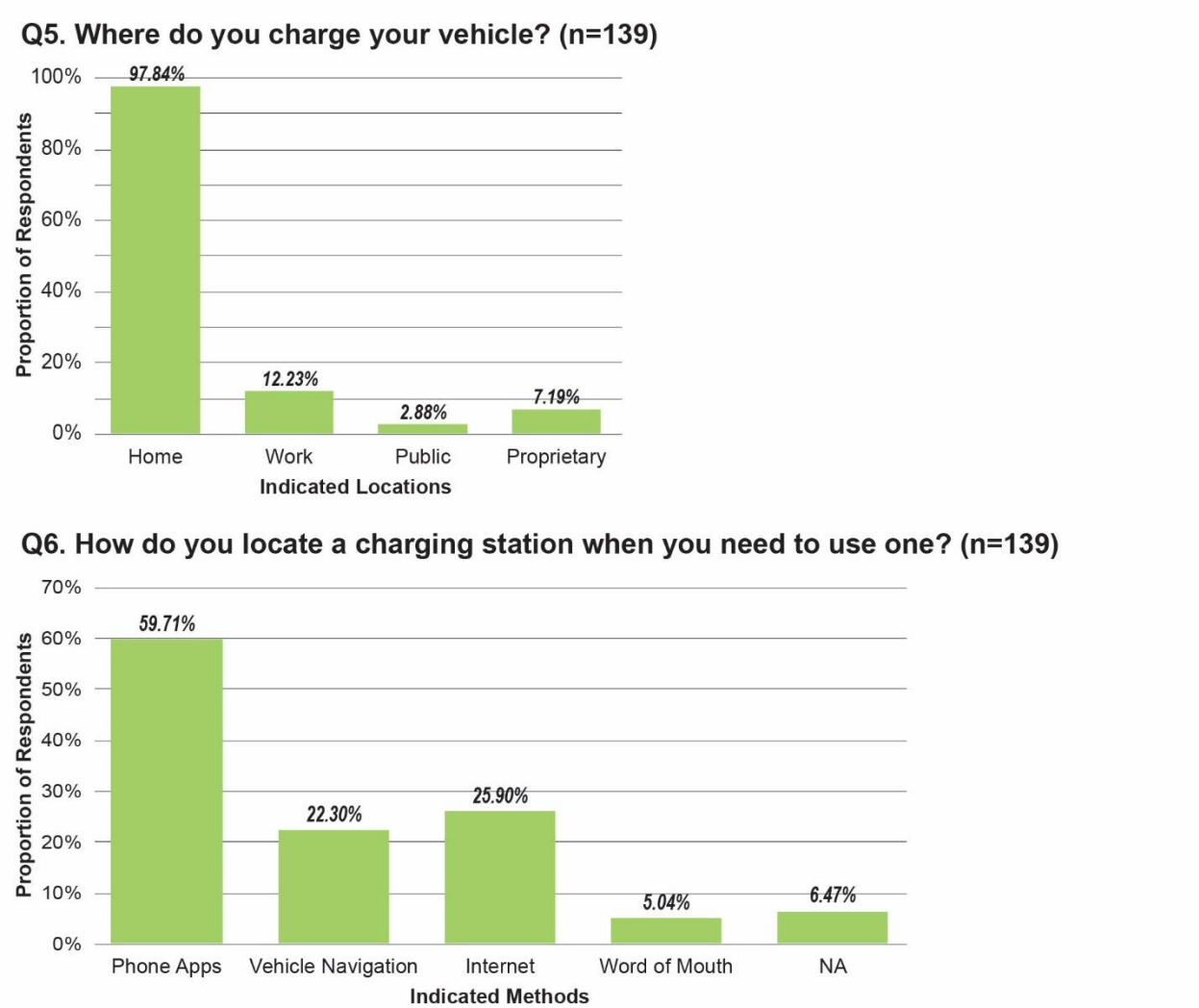

Figure 4. Where people charge their EVs and how public charging stations are located.

When asked where they would like to see additional charging infrastructure, survey respondents identified locations with four classes of geography: road corridors and intersections, generic place types, specific facilities, and neighborhoods (Figure 5). Over 20 percent of respondents identified malls or shopping centers as a location where charging stations are desired. High-traffic facilities were frequently identified, as were high-traffic neighborhoods and road corridors.

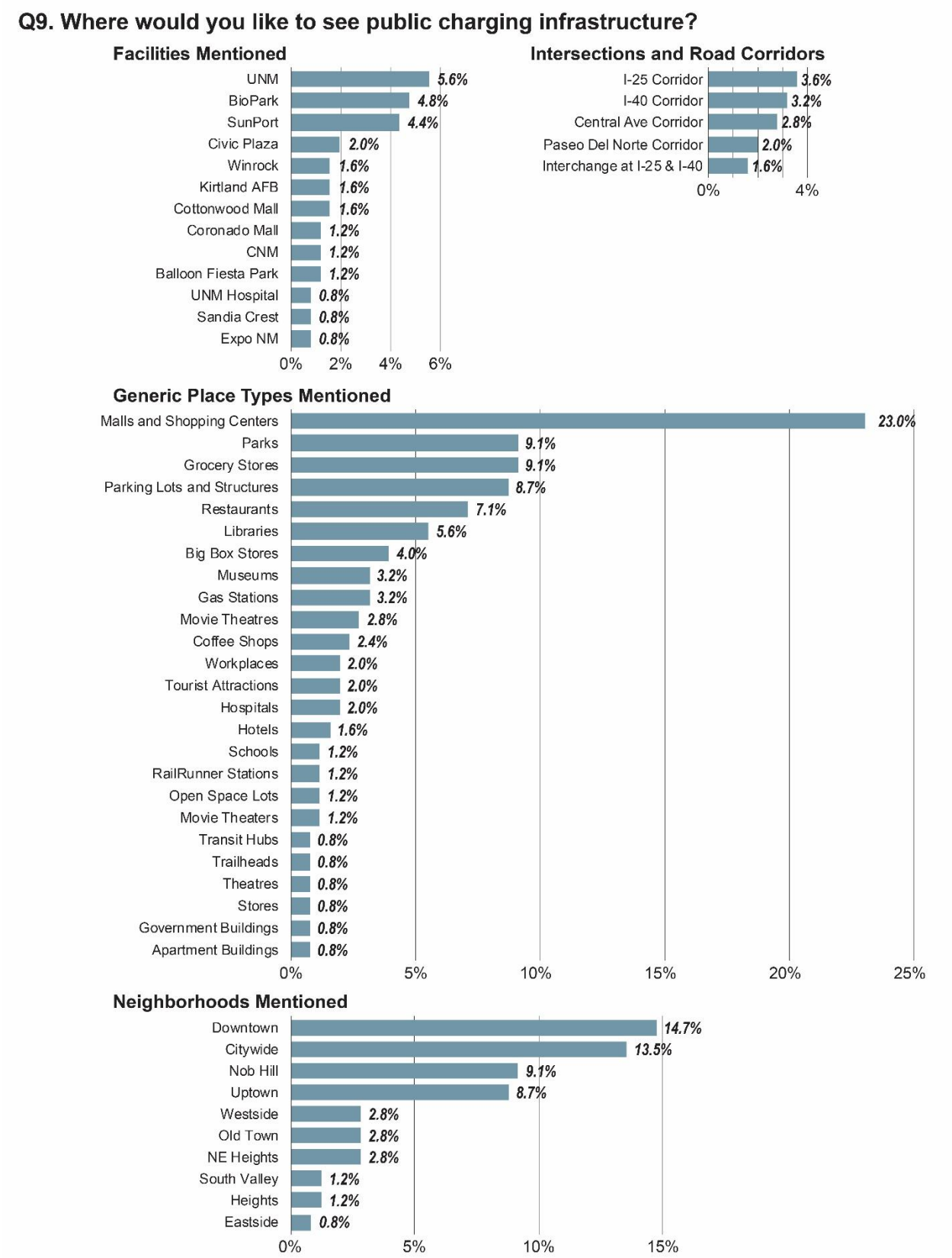

Figure 5. Locations mentioned in at least two responses are categorized by the type of location (Facilities, Intersections and Road Corridors, Generic Place Types, and Neighborhoods).

Comments

The open-ended comments that were left by survey respondents were highly variable in content, though in sentiment the vast majority were positive about additional investment in EV charging infrastructure (Table 2). Only two comments were directly critical of increased investment by the City of Albuquerque in expanding access to EV charging stations.

Table 2. Comments received in response to questions 10 and 12. "Please provide any additional comments you would like to share about electric vehicles."

1	One of the best things the city can do is enact and enforce parking restrictions to only allow active charging EVs to park in charging spaces. I am willing to pay a fair price for charging comparable to utility rates. Some charging stations charge a few dollars per hour, which is more expensive than gasoline. In order for public charging stations to work, they have to reflect the substantial cost savings compared to gasoline.
2	(1) Should be DC fast charging from 30 kW - 200 kW, and charge by the kw-hr (not by the time, except for a time penalty charge for after the car is fully charged so that people do not leave their cars parked indefinitely). (2) Probably best near major freeways so that travelers can make use of (and pay for) charging stations. (3) Parking spots ONLY for EVs; ICE vehicles will be ticketed and heavily fined; (4) Should be able to pay with any major credit card -- NO REQUIREMENT for creating an account via signing up for a specific network, having a special charging card. etc. In short: Make it EASY, make it FAST, make it REAONSONABLY priced (say, for example something like twice the going residential electricity rate) and make it FAIR (meaning, charging for actual kw-hrs consumed plus some fixed connection fee would be reasonable)
3	98% of charging is at home
4	ABQ should run completely on solar and wind <3
5	All the CHAdeMO in Abq are currently broken.
6	Allow EV companies like Tesla to operate legally in this state. It's a travesty that the hundreds/thousands of Tesla owners driving sustainable cars cannot get auto service locally because of the greed of our local dealers. Our Governor wants to be the "sustainable energy" governor and make NM the Clean Energy state but she won't stand up to car dealers to put more EVs on the road. It's absurd frankly. What's the point of having charging stations when we can't even service our cars without driving to a Colorado (an actual clean energy state)?
7	allow Tesla to service their cars
8	Also consider rental bikes/electric scooters
9	An ordinance that would discourage blocking or vandalizing of charging stations with significant fines. A campaign by the city to promote sustainable energy use, a part of which is electric vehicle use.
10	Anywhere downtown would be great since I work downtown. There probably already are some downtown though I imagine.
11	As we have a plug-in hybrid with a 53 mile range, we generally charge at home. If we run out of charge we would pay only if of were cheaper or the same price as using gasoline.
12	Bring back free parking for "green" vehicles, please
13	Bring back no fee parking sticker for downtown/central ave for no emissions cars.
14	Charge the stations themselves with solar panels; increase renewable capacity of the city.
15	Charging should be subsidized
16	Charging station s/b solar
17	Charging stations don't need to be in prime parking spaces, especially if they are free. EV drivers shouldn't mind walking a little further for the convenience of being able to charge. I suggested tennis courts (Jerry Cline, Sierra Vista, North Domingo Baca, etc.) because people are usually there for less than 3 hours. Setting up someone to charge for 8 or 9 hours while they work should be the employees responsibility. The places mentioned also have parks and swimming pools, so the charging wouldn't be specifically for tennis players. Businesses and malls should provide charging stations for EV drivers, because they would directly benefit and don't need the city to subsidize.
18	Convenience is key! Install in locations where drivers naturally spend their time: at workplaces, gyms, shopping centers, and restaurants. Incentives or assistance for landlords or employers to install charging stations will foster greater adoption among those with longer commutes.
19	Costs within reason and a better understanding of where the tax revenue will be generated/created
20	Cover parking lots with solar panels, provides shade and power
21	Discount off purchase price for public service active and retired professionals and contractors, students, first responders, teachers and volunteers.
22	Disturbing that vandalism to EVs increasing and 'Icing,' or blocking access to chargers with petrol cars occurring, so perhaps a new ordinance imposing substantial fines for these offenses?
23	Don't seem fully ready for prime time, and expensive
24	downtown charging stations please. Charging stations at supermarkets and other stores.
25	Dual Tesla and non-Tesla units at side-by-side spaces work well.

26	Dump “clean diesel” buses. Go all electric
27	Electric vehicles are the way of the future in a state that is transitioning away from fossil fuels, we need to make electric charging accessible to all our citizens regardless of our financial status. Making electric charging accessible is not just about convenience, but ultimately about climate equity
28	Encourage local businesses (hotels, diners) to install through education of benefits and use cases (dine and charge, stay the night and charge). Charging in Albuquerque is not of use to me since I live in ABQ and have ready access to home charging. Public charging is for travel purposes and out-of-town users.
29	Enforce non-EV vehicles that are parking in the few EV only charging parking spots around town. Big issue.
30	EV parking decals should be free of charge.
31	Everybody needs an electric vehicle in their lives. Give us those good charging stations!!!
32	Everyone is making mistakes with EV charging, Level 2 charges don't cut it. You need Tesla Superchargers and for others DC fast chargers. Tesla outsold 19 other EVs combined last year. I would focus on Tesla chargers other EV are not even close and now Tesla is starting at $39k. 99% of EVs I see are Tesla.
33	For benefits such as free parking, it would be nice if the sticker were permanent or not needed for electric vehicles.
34	Future public charging should be DC fast charging, support all the current standards and allow direct credit card use rather than requiring an app.
35	Go electric!
36	Good move to plan now and get in front of the curve.
37	Have Tesla build a gigafactory
38	I believe electric vehicles will become the norm in transportation. We need to anticipate this need.
39	I believe that if we wanted to maintain the beauty of the city, we need to reduce the pollution before it becomes an even more significant issue. Incentives to operate all-electric vehicles would be one of the steps necessary to take.
40	I believe they should be subsidized greatly and perhaps offer some kind of state rebate on the purchase of an electric vehicle.
41	I can charge at home so it's less of an issue for me, but public chargers would be great for people who live in apartments or in other situations where they can't install a charger. It's nice that the city is thinking about this. It's frustrating that the state has twice failed to amend the laws so that Tesla can sell and service vehicles in NM. The store I purchased mine from was clearly producing a lot of tax revenue and jobs for Colorado.
42	I desperately want to own an electric vehicle.
43	I don't know enough about the cars and technology to answer well, but it would seem that since everyone has electricity at their homes that their cars would be charged at home. For travelers it would make sense to locate charging stations where people stay in hotels; Journal Center, uptown, airport, UNM/CNM, KAFB / Sandia Labs area.
44	I have a hybrid right now-- didn't feel that the infrastructure was quite ready for electric, but would be very willing to go electric in the future.
45	I have asked Costco to put one it. Need more down town.
46	I have plans on purchasing a Tesla in the future. I would like to see NM More friendly with the company
47	I have the level II, j1772 plug. No quick charge. Non-tesla. I'd recommend something like parking meters. Pay to charge. If you aren't charging, don't use the charge spot.
48	I hope the city will commit to supporting all electric vehicles as they will help our air quality daily even so far as using them as city vehicles.
49	I hope the cost of electric vehicles goes down and is more competitive with regular cars in the future.
50	I just returned from the Bay Area, and being able to charge while I am eating at a restaurant, fast food joint, or shopping, was very convenient.
51	I live in Las Cruces, but travel a lot. The lack of rapid charge stations along I-25 and in Albuquerque make it so I have to take a gas car to do freelance work in Albuquerque and Santa Fe. I'd rather take my LEAF. Electrify America plans to cover the I-40 corridor with rapid charging, but the City of Albuquerque would increase EV adoption a lot more by partnering with the state and other cities to cover I-25 south of Albuquerque. This would not only benefit other parts of the state, but would make buying EVs a lot less scary for people in Albuquerque. At minimum, DCFC stations are needed in Socorro, T or C, and Las Cruces. A few more in Alamogordo, Carrizozo, Carlsbad, Roswell, Vaughn, Cuba, Farmington, and Silver City would connect the whole state.
52	I love my chevy volt
53	I said I was going to buy one, but that's only if my current vehicle gives up on me
54	I think charging stations for electric vehicle owners is more likely to be important for when they are travelling. Sure, having a charging station is a nice safety option if for some reason we didn't do a full charge at home. I'm wondering how I could take my car to Durango as it doesn't appear like there are many charging spots. Similarly for Albuquerque, that would be a concern for anyone travelling here. Another concern would be, what can I do while I wait for a charge? If it was a park near the river, I could go for a short walk. Or perhaps at the mall or other shopping centers where I could get something done while charging up.
55	I think electric vehicles of all types have the potential to make Albuquerque a much more attractive place for all of us, improving economic and community development at the same time. Let's do it!

56	I think electric/hybrid vehicles are great and could be the future. Not replacing fossil fuel cars, but supplementing. If only we could remove the stigma that they are slow, ugly, and inconvenient to charge.
57	I think it would be great, however I will probably not buy one for another 10 years or so. I like seeing Albuquerque on the front lines of positive climate impacts.
58	I think supporting electic vehicles is important considering how our sprawling population makes mass transit economically challenging to maintain.
59	I think this is very important for our children's future & well being, thank you for this survey & pushing this forward.
60	I totally support electric vehicles. Good for the environment & makes us independent of foreign or any oil & gas.
61	I would be willing to pay but free charging would incentivize people to switch to electric.
62	I would be willing to pay if there was a secure payment option, but card readers can be hacked. Not sure I would trust the payment delivery options.
63	I would like to see charging stations in rural NM. So perhaps a partnership with small communities Would love to see stations on top of the Sandías for example.
64	If it's prohibitively expensive, few peopl would take advantage. Free wpuld be best.
65	If more charging infrastructure was available, I would have bought a full electric car. I would like to see more incentives like free parking, or some sort of rebate or help to install charging station at home.
66	If the cost of charging doesn't include excessive fees (i.e. no $2 service charge for $0.15 in electricity on a 30 sec charge), happy enough to pay. Not interested in buying yacht fuel for some 3rd party "service provider"
67	If we want to encourage travel to NM we need charging stations! And this is part of moving in the right direction to stop climate pollution
68	I'm NOT "picking" on anyone, just want to cause a smile. [PERSONAL INFO REMOVED]. EVs Rule! Thanks for doing this.
69	Incentivize apartment owners to build them . Work with car rental agencies to install chargers in their lots and rent EVs so people can experience them
70	Infrastructure is what it will take to effectively transition away from fossil fuel dependence.
71	Install affordable High Speed Charging in many locations, including at the City parking garages and the Airport in order to improve adoption. Additionally, the City should use Electric vehicles where ever appropriate. Also, encourage usage by providing lower parking prices and/or better parking locations at City lots. Partner with the US Postal Service, the DOD, the DOE, and Sandia National Laboratories, the Rail Runner, the State Land Office, the State of NM, UNM, and CNM to get more charging stations installed and used.
72	It can only go 80 miles which when using air conditioning for heat uses those miles faster. I need more charging stations to be able to keep it here in Albuquerque.
73	It is a very good thing to be emphasizing energy efficient means of transport, and by installing more power stations I hope to see more electric vehicles on the road.
74	It would be great to be known as aCity that promotes the use of electric cars and encourages tourists with electric cars to come here because of ease of charging.
75	It would be great to see Albuquerque eve friendly!
76	It would be neat if the city could work with restaurants, malls, office buildings to partner in developing charging stations. That way they are at locations where folks would be parked for some time anyway and might help offset some of the cost. I would be willing to use and pay for the charging station if they were powered by renewable energy.
77	It would be nice to see charging stations in all areas of the city and not just downtown or in Knob Hill.
78	It would be such a great step forward for the city transport to be electric and needed to start now.
79	It's the future. Thank you for looking into the future and advancing our city instead of playing catch up later on
80	It's the near future. We are not going back to steam or coal, so go forward proudly. Just not blindly.
81	Just want thank you for planning this. Since we got our Nissan Leaf 3 years ago we were hoping the infrastructure would catch up. Thank for moving Albuquerque forward.
82	Let's do this!
83	Lol gas.... The metal Mayor is the shit btw.
84	Love em! Work with Go Station for fast chargers
85	Love my EV
86	Maintaining charge stations is a big deal. I used to have 100% electric car (BMW i3) but charge stations in ABQ and Santa Fe were often not working, thus the current plug in hybrid
87	Make sure it's done thoughtfully and not like ART.
88	Make them at least partially solar- or wind-powered. We should be transitioning to solar energy in New Mexico. With the proper infrastructure and improved battery technology, the Southwest could power the United States.
89	Many cities have made it a requirement for all new residential structures developed to include a nema 14-50 outlet in the garage that can be used to charge an ev. I would love to see Albuquerque make this a requirement as I think it would help to lower the cost of ev adoption by abq residents in the long run.
90	Many Tesla's come with free supercharging for life. I'm assuming most people are going to charge their cars at home. Not sure if it's worth it for the city to invest in charging stations, especially with how fast the technology is changing.
91	Maybe consider a program for places of work to have them installed depending on number of employees, etc. also along the interstates. Most vehicles have a long enough range folks will charge them at home.

92	More chargers at or near unm that are not in pay parking garage
93	Need to allow Tesla and other car companies to sell cars in Albuquerque and New Mexico.
94	Need to be more educated about technology and logistics
95	New Mexico needs to be a leader in green initiatives, not a follow. Look to Colorado for inspiration and then do better.
96	NM should welcome all electric vehicles
97	No point in installing trickle chargers. If I can't completely charge my car in 4 hours, I'd just charge it at home.
98	Not sure if PNM already offers, but if not, it would be great to offer an incentive rate for people who charge their EVs at home!
99	Part of the appeal of EV's is that they require less maintainable and are less expensive to fuel. If you were to charge for use I implore you to look at any alternatives to create revenue (i.e. having them sponsored, having ads play on them, etc.). Or at least making sure that what you charge is reasonable.
100	Passing Tesla bill will help ownership in NM. Additional tax incentives will encourage purchase and ownership.
101	Paying has to be worth not just waiting to go home to charge. Extra fast AC and relatively cheap.. 15 cent per kw. Or up to 25 cents per kw on dc charging. Or use it to bring people to areas for a “free” charge as an incentive to increase potential foot traffic to businesses.. ie I buy at shops downtown and also contribute to the budding vibrancy in the area while waiting on a charge from time to time.
102	perhaps reach out to Tesla, after all its Teslas that we will be recharging. Don't pay for their infrastructure, allow electric mfrs to foot the bill
103	Planning to purchase an EV by June 30.
104	Please incentivize electric vehicles in ABQ! This town is perfect for them!
105	Please install them! We need charging stations so people will feel comfortable buying them!
106	Please make this happen. Thanks
107	Please provide tax incentives or rebates for businesses to install their own charging stations as well.
108	Priority designated parking
109	Public support for the transition to more widespread use/ownership of electric vehicles will have a positive impact. I happily would pay to use a charging station as long as the payment covers costs and is not designed to make a profit.
110	Rapid adoption of electric powered transit is absolutely imperative for ABQ and NM
111	Schools and public buses should become electric and charging stations should be located in those garages as well as at schools.
112	Should be more designated electric parking spots to promote the switch
113	Solar or wind generated power available at charging stations if feasible would be an eventual goal to meet. Personally I would like the same at home.
114	State laws need to change to allow Tesla to do business in the state. Current laws put in place by auto dealer lobby who are fighting to keep Tesla out simply because of the competitive threat. Unfair to NM citizens. Tesla owners in NM need local Tesla service centers, instead of having to go to AZ, CO, or TX. Situation is ridiculous. NM becoming laughingstock of the nation for its fear of challenging the entrenched auto dealer monopoly.
115	Stations in the NE would be great. Partner with the JCC
116	Suggest the city make a plan to go electric with police cars
117	Tesla provides free charging equipment and cover installation costs for destination chargers, only the electricity needs to be paid for. City of Las Cruces have installed few such chargers.
118	Tesla super chargers
119	The city should bring back the green vehicle parking permits.
120	The city should do what it can to encourage EVs... free parking, etc.
121	The city should lead by example and purchase EVS for the city fleet!
122	The city use to issue yearly green parking permits for electric / hybrids to park for free. It would be great if this happened again.
123	The current "incentive" for electric vehicles is a joke. Paying $25 for a permit to park "free" makes no sense and provides no reward for not spewing poison into the air.
124	The electric chargers on 3rd street downtown are always being used- we need more!
125	The future is electric, if the city caught up with other larger cities the city would be more green.
126	The lack of chargers (and charger enforcement, i.e. The Salt Yard, which has one of the few public chargers but allows gas vehicles to take those spots) is prohibitory for spending money on some occasions. EV drivers are forced to make a value judgement between where they’d like to go and where they can go. If chargers were more available, EV drivers would be attracted to local restaurants and districts instead of worrying about if they could get there and back.

127	The Nob Hill police substation, and the Old Town police substation are prime locations, in my opinion. An additional set at the Plaza would be helpful too. Tramway and Public Library locations might be interesting, for a second wave of deployment, but I am concerned that the cables will be a target for copper theft, without the sheltering effect of being at a Police node. The city may be interested in seeking consultation on using aluminum cables. The city might house library chargers in locking enclosures, with hours that mirror those of the location. Perhaps there is a solution which would have the cable itself, emboxed in a knight's armor — such that the cable would see less abuse from being kinked or left, dropped to the ground, by careless users. As connectors go, J1772 is the closest to being universal at this time. As a point of curiosity, one might visit the Albuquerque Hispano Chamber of Commerce. There is a disused charging station, which has an obscure type of connector, in their parking lot. That may give the planner pause, on how many locations might be deployed, and the scorching effect of our New Mexican sun. It would be in the interest of the city to contact Tesla Motor Company, regarding this project. They may provide data on whether they are planning to expand their local network, and some collaboration in an Old Town station, or an amiable Balloon Fiesta location, may be achieved. ~^~ In closing, I am delighted by the prospect of the city taking the initiative for this project. It is the perfect time to spearhead the development of a basic network — one that will be the backbone for charging, in the years to come. As "used" electric vehicles enter the market, there will be a need for charging, beyond that of a flashy convenience for tourists, or, owners which might just assume charge their vehicle at home, yet could be enticed to visit the library for a few hours, or to grab a sandwich while they wait. As these vehicles become more ubiquitous, those citizens which are living in apartments may be tantalized: an electric vehicle is cheaper to fuel and maintain, but, aside from running an extension cord out the window, or, scupping their time finding an available charging station, and sitting around while waiting for their car to top off, having one of these vehicles might be a source of new hells, and unspoken punishments. Fast charging has been touted as a solution, but there is a downside. This process of pushing electrons produces heat. Heat reduces the life of a Lithium Ion battery. To account for this, the air-conditioner for the vehicle is applied to the battery — more energy faster, but more energy used overall. (Any owner of a cell phone may also learn that topping off the battery does less good, than nearly depleting it, every once in a while, and slowly charging it to nearly full, seems to give it more power.) For the system which you have planned, data and survey is a grand hope — however, there will be monsters in the numbers. It may seem that Nob Hill is a popular location, and that this is where more chargers are needed, but, it is more likely that folks will be making a pilgrimage to use them, as they would rather spend an hour there, than a less desirable spot, nearby to home — a hinderance to actual deployment, and real ubiquity, expansion in coverage. The Tramway location may see useage at odd hours, but it may turn out that it is being used by someone living out of their car, and there is no real need for additional infrastructure. It may be that Bob The Architect, and cheap-ass, works downtown, and always arrives fully charged, but he would prefer to hog the station for hours at a time, because he is billed by the kilowatt. (This! This is important! This will be annoying!) If you are still reading, I do have some solutions in mind for the problems which will be encountered, and, I am glad to meet with you to discuss. [PERSONAL INFO REMOVED]
128	The west side is something of a dead zone for chargers (Tesla owners excluded). When I select chargers, I frequently look for chargers near cafes or shopping areas, as I can shop or eat while my car charges.
129	There should be a mix of level 2 (maybe at no charge) and level 3/fast charge (for a fee).
130	They are pretty great. I'd like to see more solar based chargers around town. The ones at Sandia Labs work fairly well.
131	They need to beasconvie t as gas pumps are now, and they need to be quick charging.
132	They should be a no-brainer. They're cleaner, more future-proof, and even faster than internal combustion. Anybody who wants the fastest factory car for their money right now and isn't buying electric is a fool.
133	This would be a great initiative for the City! Do it!
134	Use your political clout to allow Tesla to open service centers in New Mexico
135	Very important to use solar energy to power electric vehicles- otherwise it's not saving the environment anything!!
136	We are experiencing the transition from the horse and buggy to the horseless carriage all over again. Though the transition will result in overwhelming public good, some see only their personal interest at risk (dealers association).
137	We have to do everything possible to encourage people to switch to electric cars.
138	We need a Tesla service center
139	We need more free charging stations at stores and restaurants.
140	We should also have the option to have our vehicles serviced in NM.
141	We should return to free parking at meters!
142	We used to have EV parking stickers as incentive to own a no emission EV. That was taken away. I would love to see that reinstated ! We charge from the sun and are helping the air quality of the city, the state and the planet. That should be encouraged.
143	What I said above. EV are not something that is marketable to working and middle class Americans- as our wages remain stagnant- EV vehicles are expensive. Enacting A GND and FJG by the federal government using MMT can help combat this issue.

144	When making trips to CA ...to LA area... we tried to plan our charge stops around meals and hotels, stop for coffee or shopping structures we could get errands done. Time saving convenience dictated our venue choices... so a placement of chargers near a variety of shopping choices would also draw customers insuring constant usage
145	Why all in for electric vehicles while removing benefits or making it more costly to own ultra low emission hybrid vehicles? Mixed messages for sure. Need to return the free parking permit for hybrids and emissions testing exemptions that the republican mayor did away with.
146	With the amount of sun that Albuqueruqe receives, it's an easy fit for electric vehicles, recharged by solar power.. Electric cars will also help a lot to reduce pollution - both air and noise.. Let's do it!
147	Work on solar power as the source
148	Would be extra cool if powered partially by solar and located near shops or cafe (similar model to current supercharger network).
149	Would love to see increased support for electric vehicles!
150	It's not governments job or place to provide infrastructure for the handful of people that have electric vehicles. There are far better ways to spend tax payers money. Let the market, consumers and businesses determine if the technology will work and invest in it. The market will build the infrastructure to support electric vehicles if that is what people want.
151	N/A
152	Recently purchased a vehicle a few years ago and plan on driving it until it is old.
153	There are not as many options for electric vehicles on the market
154	You can't even drive a hooptie in Albuquerque without someone vandalizing it or stealing it. Since your major quit worrying about dumb ideas like this. Start cleaning up the streets and quit using the extreme left ideologies to comform to the road that'll lead to a disaster. It's like painting over this disgusting city, "You can put lipstick on a pig but it's still a pig". Make this city a safe and enjoyable place to live then talk about ideas such as this one.

References

Idaho National Laboratory. 2015. "Plugged In: How Americans Charge Their Electric Vehicles," 1–24. https://avt.inl.gov/sites/default/files/pdf/arra/SummaryReport.pdf.