

# Equitable Transportation Electrification

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Although increasing efficiencies in the power and building sectors and alternative energy sources<sup>1</sup> have driven down the nation's greenhouse gas emissions, mobility has continued to increase, making transportation the largest contributor to nationwide greenhouse gas emissions. As a result, the United States is one of the few developed nations in the world where the energy intensity of transportation is worsening.<sup>2</sup> The subsequent air pollution resulting from combustion emissions is responsible for approximately 5 to 10 percent of premature mortality in the United States every year.<sup>3</sup>

Such emissions disproportionately impact racial and ethnic minorities in the United States, with documented disparities persisting even as decreases in overall national air pollution levels are observed.<sup>4</sup> These disparities are attributed to a history of neighborhood disinvestment, inequitable housing policies, and planning that often places large traffic thoroughfares near minority and low-income neighborhoods. Vehicular traffic, including light-duty and heavy-duty gasoline-powered vehicles, are often among the largest sources contributing to these impacts. Such findings underscore the value of transportation electrification as a meaningful strategy to achieve significant greenhouse gas emissions reductions, and also an opportunity to transform communities and reduce disparities. Without broad-based transportation electrification in all communities, it is increasingly unlikely that communities will be able to achieve the deep carbon reductions necessary to meet emissions reduction targets.

The likelihood of transportation electrification having wide-ranging benefits—and equitable impacts on the population at large—is reinforced by evolving consumer attitudes toward electric vehicles (EVs) and technological advancements, such as increased EV model availability, longer vehicular range, and shorter EV charging times. If transportation electrification does not account for equity, broad-based transportation electrification will not only be impossible, but the many benefits of electrification will not extend to the most vulnerable communities, further exacerbating existing inequities. To achieve goals of equitable impact, transportation electrification efforts must make equity a focal point by using data-driven decision making, enabling lower-cost markets for EVs, offering innovative program structures and incentives, investing in public charging networks with accessible siting locations, and partnering with utilities and local governments to collectively advance these goals.

<sup>1</sup> Sources of Greenhouse Gas Emissions, EPA, 2021.

<sup>2</sup> Highashide, Steve. (2019) *Better Buses, Better Cities*. Washington: Island Press.

<sup>3</sup> World Health Organization Health Risks of Particulate Matter from Long-Range Transboundary Air Pollution (WHO Regional Office for Europe, 2006).

<sup>4</sup> Tessum, C.W., Paoletta, D.A., Chambliss, S.E., Ape, J.S., Hill, J.D., and Marshall, J.D. "PM2.5 pollutants disproportionately and systemically affect people of color in the United States." *Science Advances*. 7. (2021).

## The Value of Equitable Transportation Electrification

Increased transportation electrification and the resulting decarbonization advantages cannot be realized without first addressing the existing inequities in the mobility landscape. Studies show that a long commute can be one of the biggest barriers to escaping poverty.<sup>5</sup> The inability to afford a vehicle or the lack of simple and efficient mobility options can make it difficult to access critical services, employment, job training, continuing education opportunities, and community events. The impacts of access disparities are significant, and the long-term effects may be felt in communities for multiple generations.

An equitable electric transportation ecosystem is one in which all populations have electrified transportation options that enable sustainable and reliable access to services. Equity prioritizes the needs of marginalized communities (e.g., historically disinvested and legacy inequities) and vulnerable populations (e.g., special needs populations), as well as fair and just distribution of infrastructure investments. Low-income communities, communities of color, and vulnerable populations stand to benefit tremendously from vehicle electrification. While transportation electrification can empower communities, transit agencies, and utilities to reduce emissions and meet climate targets, equitable electric transportation has the added value of improving community livability and mobility access as well. Reducing emissions helps to alleviate adverse health impacts associated with air pollution, and reducing transportation costs helps alleviate transportation cost burdens, both of which disproportionately impact marginalized communities and vulnerable populations.

### Existing Electrification Barriers

To ensure equitable adoption of EVs, policy makers, utilities, community organizations, and vehicle manufacturers must understand the specifics of EV adoption barriers and how they may present differently in disadvantaged

communities. Broadly, the barriers that limit purchase and adoption of EVs fall into three categories: infrastructure and technology considerations, economic considerations, and social factors. Particularly in vulnerable communities, these barriers will require policies, programs, funding, and outreach strategies specifically targeted to address each of these categories in a way that promotes equity.



**Maintaining the transportation status quo will only widen the equity gap.**

### Infrastructure and Technology Considerations

Access to charging infrastructure and vehicle battery technology are critical considerations for all potential EV owners. In recent years, EV technology has advanced at a rapid pace, with vehicle battery capacities continuing to increase, development of new EV types and models, and faster EV charging technologies. Combined, these make EVs an increasingly feasible option for broader populations. However, the large majority of current EV owners currently charge at home,<sup>6</sup> an arrangement that requires a dedicated home parking space and the ability to retrofit this space with an EV charger. These requirements have, to date, limited the ability of drivers living in multifamily or rental housing to own EVs. Some states, such as Florida, have begun to introduce legislation that requires condominium homeowner associations to allow owners within their buildings to be able to install EV charging infrastructure.

Although the public EV network continues to expand, with over 41,000 stations currently in the United States,<sup>7</sup> there

<sup>5</sup> Harvard Equality of Opportunity Project, <https://opportunityinsights.org/>

<sup>6</sup> Halvorson, Bengt. "EV drivers are sticking to home charging while public networks expand." Green Car Reports. September 14, 2020. [https://www.greencarreports.com/news/1129596\\_survey-ev-drivers-are-sticking-to-home-charging-while-public-networks-expand](https://www.greencarreports.com/news/1129596_survey-ev-drivers-are-sticking-to-home-charging-while-public-networks-expand)

<sup>7</sup> U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy's Alternative Fuels Data Center. Electric Vehicle Charging Station Locations.

are deep inequities in the distribution of this infrastructure. A recent study<sup>8</sup> of public charging stations in California found that majority Black and Hispanic communities consistently have lower access to public charging stations than majority White communities, even when normalized for proximity to highway infrastructure, where public EV charging stations are more likely to exist. The same study also found that among communities with a high density of multifamily housing, those with a higher median income were more than twice as likely to have public charger access than low-income, multifamily housing communities. The lack of charging infrastructure investment exacerbates existing inequalities by limiting the ability of communities of color to successfully own and operate EVs and thereby realize the associated air quality and life cycle cost benefits.

## Economic Considerations

While operations and maintenance costs of electric vehicles are cheaper than their internal combustion engine counterparts, the initial capital cost of purchasing an EV is higher. Consequentially, many states in the United States are introducing incentive programs, such as rebates, to help consumer purchase EVs. Still, the upfront cost of new models remains a large barrier, particularly for low-income communities, and the used EV market remains nascent due to the relatively limited number of EVs manufactured in past years. As the market continues to rapidly evolve, more vehicle types, affordable options, and even a second-hand EV market are expected to emerge within the next few years.

Given the relatively high cost of purchasing an EV, decision makers will need to assess how to reduce the barriers presented by the upfront capital costs of EVs and recognize that, while EV adoption patterns can evolve with new vehicle technologies, without affordability and/or incentives that enable low-income consumers to purchase EVs, significant adoption will likely not be seen.

## Social Factors

Despite advancements in EV technology and the increased availability of public EV charging stations, consumer knowledge about EVs remains a general barrier to EV adoption in the United States. For example, industry surveys indicate more than half of Americans believe an EV would not have sufficient range for their driving needs, and they are less likely to purchase an EV because of their perception that there would not be enough places to charge. In contrast, 77 percent of actual EV owners report having less or no concern about range.<sup>9</sup> Additionally, studies have demonstrated that many prospective vehicle buyers are unable to name specific EV models, a barrier to feeling comfortable making such a purchase.<sup>10</sup>

While these gaps in knowledge about EVs exist across all demographic groups, they are larger among groups with lower household income and educational attainment. Existing EV education and awareness trends further exacerbate inequity in EV adoption. Recent studies have demonstrated that existing EV owners are a primary source of information for new EV owners, and knowing an existing EV owner is a primary predictive factor in future EV buyers.<sup>11</sup> Consequently, intentional, culturally relevant outreach must be conducted to bring EV awareness and education to communities without existing EV owners or advocates.

Although the need clearly exists for further research and policy innovation in development of equitable EV outreach methods, there are anecdotal examples for bridging these social barriers. In Seattle, WA, a local credit union partnered with an environmental justice organization to create bilingual EV education events. Participants receive information about EV technology as well as funding and financing options, including advantageous EV loan programs and local utility resources.<sup>12</sup>

<sup>8</sup> Chih-Wei Hsu and Kevin Fingerma, "Public electric vehicle charger access disparities across race and income in California," *Transport Policy*, Volume 100, 2021, Pages 59–67, ISSN 0967-070X, <https://doi.org/10.1016/j.tranpol.2020.10.003>

<sup>9</sup> AAA: Owning an Electric Vehicle is the Cure for Most Consumer Concerns." By Ellen Edmonds, Manager, AAA Public Relations. AAA Newsroom. 1/22/2020: <https://newsroom.aaa.com/2020/01/aaa-owning-an-electric-vehicle-is-the-cure-for-most-consumer-concerns/>

<sup>10</sup> Kurani, Kenneth S. Policy Brief: The State of Electric Vehicle Markets, 2017: Growth Faces an Attention Gap. Institute of Transportation Studies, University of California, Davis, 2019. Brief UCD-ITS-RR-19-20. [https://itspubs.ucdavis.edu/publication\\_detail.php?id=3051](https://itspubs.ucdavis.edu/publication_detail.php?id=3051)

<sup>11</sup> Hardman, Scott, Kenneth S. Kurani, Debapriya Chakraborty (2020). "The Usual Policy Levers Are Not Engaging Consumers in the Transition to Electric Vehicles: A Case of Sacramento, California." *Environmental Research Communications* 2 (8) <https://escholarship.org/uc/item/4ck530xw>

<sup>12</sup> National Resources Defense Council. "Cities Turn to Virtual Electric Education in 2020." October 2, 2020.

## Impacts of Inequitable Electrification

Inequitable electrification investments and unaddressed barriers to electrification exacerbate existing inequities and can worsen public health and transportation cost burden, which is linked to access to critical services.

### Public Health

Transportation-related emissions are highest near high-traffic thoroughways, such as highways and main roads, generally in urban areas. In general, diesel particulate concentrations have also been found to be higher on urban routes compared to suburban ones. Emissions from these areas disproportionately impact neighboring communities, which tend to be communities of primarily low-income and minority residents. Investing in electrification within minority and low-income communities will help to reduce pollutants in neighborhoods that experience disproportionately high exposures, thereby not only reducing emissions, which contributes to climate targets, but also supporting public health efforts and long-term wellbeing. Further, these actions would support Executive Order 12898, *Environmental Justice in Minority Populations and Low-Income Populations*.<sup>13</sup>

As shown in a study a study conducted by the California Air Resources Board (CARB), even small periods of time on high-traffic roads can significantly increase emissions exposure. For example, the study found that even though a child's school bus commute accounts for less than 10 percent of their day, the exposure from the ride amounts to nearly 33 percent of their daily exposure to air pollutants.<sup>14</sup> Consequently, CARB has introduced lower-emissions school bus programs and a school bus idling program that limits school bus idling at or near schools to only when necessary for safety or operational concerns. An additional solution might be electrified bus fleets, which would represent a meaningful opportunity to significantly reduce emissions exposures to young children and other vulnerable populations.

### Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Source: <https://www.epa.gov/environmentaljustice>

### Transportation Cost Burden

Transportation is essential for accessing critical services such as food, jobs, healthcare providers, and educational institutions. In 2019, roughly 17 percent of all residential expenditures were spent on transportation end uses, making it the second highest American household cost sector, just behind housing.<sup>15</sup> The cost burden of transportation is even higher for low-income households, who often rely on public transportation with flat rate fares that are disproportionate to their income. Others encounter an inefficient or non-existent public transportation network and are forced to purchase costly personal vehicles. Consequentially, they pay even larger allocations of their income for transportation needs and are disproportionately impacted by fluctuations in fueling costs. Maintaining the current mobility landscape and status quo regarding the transportation cost burden without providing low-income residents access to cost-effective alternatives will continue to widen the equity gap in transportation.

Vehicle electrification can be a method to reduce the transportation cost burden for Americans. It is an opportunity to achieve a cost-effective alternative to internal combustion engines.<sup>16</sup> Technological breakthroughs continue to drive down the cost of batteries, with cost parity expected to be realized between EVs and internal combustion engine vehicles by 2030. EVs are expected to reduce transportation cost burdens by lowering fuel and maintenance costs; current data suggests an annual cost savings of \$1,000 would be achieved. This reduction in transportation cost may represent as much as 7 percent of household income for the lowest-income households,<sup>17</sup> a much needed savings that can be allocated instead to other vital household needs.

<sup>13</sup> United States Environmental Protection Agency. Laws & Regulations. Summary of Executive Order 12898 – Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. 59 FR 7629; February 16, 1994. <https://www.epa.gov/laws-regulations/summary-executive-order-12898-federal-actions-address-environmental-justice>

<sup>14</sup> Children's School Bus Exposure and Mitigation Studies." California Air Resources Board. <https://ww2.arb.ca.gov/resources/documents/childrens-school-bus-exposure-and-mitigation-studies>

<sup>15</sup> U.S. Bureau of Labor Statistics. Consumer Expenditures—2019. September 9, 2020. <https://www.bls.gov/news.release/cesan.nr0.htm>

<sup>16</sup> U.S. Department of Energy Office of Energy Efficiency & Renewable Energy. Electric Vehicle Benefits. <https://www.energy.gov/eere/electricvehicles/electric-vehicle-benefits>

<sup>17</sup> International Council on Clean Transportation. Working Paper 2021-06: "When might lower-income drivers benefit from electric vehicles? Quantifying the economic equity implications of electric vehicle adoption." By Gordon Bauer, Chih-Wei Hsu, and Nic Lutsey. February 2021. <https://theicct.org/sites/default/files/publications/EV-equity-feb2021.pdf>

Proposed Solutions

The confluence of technological advancements in EVs, increasing need for public charging stations, and existing inequities in transportation access present a highly complex environment for policy makers, utilities, and transportation providers. Understanding this environment and identifying possible solutions is essential to ensuring that electrification, decarbonization, and equity objectives related to transportation are achieved.

Central to the necessary solutions is an approach to transportation electrification that is inclusive and enables low-income, environmental justice-designated areas,<sup>18</sup> and other vulnerable populations to participate. While these populations continue to face many of the most significant societal burdens such as poor community health, low incomes, insufficient mobility access, and lack of employment, they are often the last ones to participate in massive EV deployments and rollouts. Equitable scaling of transportation electrification is essential to creating the greatest electrification impact and realizing decarbonization goals. Data-driven analysis can be leveraged to effectively identify these areas of high need and high impact. When decision makers have a holistic understanding of the actions targeting disadvantaged communities. Potential solutions for consideration are summarized below.

Support Innovative Partnerships

Creating public-private partnerships that utilize the technical expertise of the private sector and the depth of community knowledge of local non-profits or governments can be a powerful tool. A thorough understanding of local conditions through workshops or surveys can lead to decisions on how to target communication methods best suited for reaching the desired community and design programs that drive EV adoption among low-income households. They can also be vital in determining the structure of programs that will succeed in specific environments, for example accounting for infrastructure limitations of low-income, multifamily housing units by introducing ride share programs. Successful partnerships have created the solutions shown below as examples and highlighted by the City of Los Angeles.

Transportation Cost Burden

Expenses included in the calculation of transportation cost burden are public transportation costs, vehicle costs, fuel costs, operations, maintenance, and insurance.

Solution	Impact or Barrier Mitigated
Offer carsharing services dedicated for low-income residents	Transportation Cost Burden, Public Health, Infrastructure & Technology
Create education programs for local mechanics and car salespeople on EVs	Social Factors
Develop multi-lingual educational materials	Social Factors
Charging as a Service	Infrastructure & Technology, Economic Considerations
Provide EV test drive opportunities at local events	Social Factors

Partnership Case Study: Los Angeles, California

In November 2019, the City of Los Angeles announced a partnership with 8minute Solar Energy, LLC, the largest independent solar and storage power plant development company in the nation. The partnership supports the development of the Eland Solar and Storage Center, which will be key to achieving LA's 100% renewable energy by 2045 supply goal. The Center will ensure that renewable power is affordable and accessible for people throughout LA, by having the lowest prices ever recorded within the United States.

<sup>18</sup> Designated as communities most impacted by environmental harms and risks, with several states allocating specific criteria for designating an environmental justice community.

## Enable Low-Cost Market for EVs

Current measures of EV purchases have been primarily associated with high income levels, indicating a barrier to EV adoption across income lines that should be addressed to see meaningful improvements.<sup>19</sup> Government organizations, electric utilities, and private developers can support equitable transportation electrification by implementing innovative programs and projects to enhance EV adoption in disadvantaged communities and reduce the cost burden of transportation, increase mobility access, and improve community livability. In California, many incentive programs have allotted a portion of funds and EV rebates specifically for low-income households. These funds have been used to reduce costs for EV owners installing charging stations, provide rebates to qualifying participants for purchasing EVs,

and subsidize all-electric carsharing services dedicated to affordable housing developments. These types of incentive programs have led to the solutions shown below as examples and highlighted in the State of California case study.

## Develop Robust and Equitable Public Charging Network

Ensuring prospective EV owners have accessible charging locations is crucial to easing range anxiety and providing a suitable option to residents who may not be able to install a charging station at home. An effective strategy is for stakeholders to collaborate and share localized data

Solution	Impact or Barrier Mitigated
Offer innovative financial assistance programs and methods optimal for low-income residents	Economic Considerations, Transportation Cost Burden, Public Health
Promote and incentivize a second-hand market for used EVs	Economic Considerations, Transportation Cost Burden
Electrify public transportation routes	Public Health, Transportation Cost Burden, Infrastructure & Technology
Offer reduced EV registration prices	Economic Considerations, Transportation Cost Burden
Develop cost-effective pricing schemes such as offering monthly subscription charging rates or ownership of charging stations	Economic Considerations Transportation Cost Burden

### Low-Cost Market Case Study: State of California

California is a national leader in providing innovative, equitable, holistic funding opportunities that broadly lower the cost barrier of transportation electrification. The success of such initiatives is achieved through the collaboration of government, transportation, energy, and air quality organizations. Incentive, rebate, and grant opportunities often have a portion of funds designated for low-income residents and can be applied to both vehicle and charging station costs. Based on these efforts, California received the top incentive deployment score (27.5 out of 30) in the nation in The State Transportation Electrification Scorecard.<sup>20</sup> The state is continuing such efforts by committing \$1.5 billion for transportation electrification in the 2021–2022 budget.<sup>21</sup>

<sup>19</sup> Environmental Attributes of Electric Vehicle Ownership and Commuting Behavior in Maryland: Public Policy and Equity Considerations. August 2018. By Z. Andrew Farkas, Ph.D., Morgan State University; Hyeon-Shic Shin, Ph.D., Morgan State University; and Amirreza Nickkar, Ph.D. student, Morgan State University. Prepared for: Mid-Atlantic Transportation Sustainability University Transportation Center, University of Virginia, Charlottesville. <https://www.morgan.edu/Documents/ACADEMICS/CENTERS/NTC/Environmental%20Attributes%20of%20Electric%20Vehicle%20Ownership%20and%20Commuting%20Behavior%20in%20Maryland%20-%20Public%20Policy%20and%20Equity%20Considerations.pdf>

<sup>20</sup> ACEEE. The State Transportation Electrification Scorecard. By Bryan Howard, Shruti Vaidyanathan, Charlotte Cohn, Nick Henner, and Ben Jennings. Research report. February 2021. <https://www.aceee.org/sites/default/files/pdfs/t2101.pdf>

<sup>21</sup> Governor's Budget Summary: 2021-22. Governor Gavin Newsom to the California Legislature, Regular Session 2021-22. January 8, 2021. <http://www.ebudget.ca.gov/FullBudgetSummary.pdf>

to model optimal public charging station locations such as at businesses, low-income housing complexes, and along curbsides in neighborhoods or businesses. Jurisdictions play a critical role in ensuring local policies and permitting allow seamless EV charging station development at the proposed locations. Such stakeholder collaborations have led to the solutions shown below as examples and highlighted in the Fresno and King Counties case study.

Solution	Impact or Barrier Mitigated
Count EV charging stations toward minimum parking requirements	Infrastructure & Technology
Require EV capable spaces in the building code	Infrastructure & Technology
Develop data-driven Electric Vehicle Readiness Plans (EVRPs)	Public Health, Transportation Cost Burden, Infrastructure & Technology
Site charging stations in disadvantaged communities	Transportation Cost Burden, Infrastructure & Technology

### Public Charging Station Case Study: Fresno County and Kings County, California

The Fresno Council of Governments and the Kings County Association of Governments launched their Electric Vehicle Readiness Plans in 2021 and 2020, respectively. The plans focus on prioritized siting for EV charging infrastructure based on equity and community needs. The recommendations in both documents incorporate extensive stakeholder and community engagement. Following the analysis, the Fresno County Rural Transit Authority implemented an all-electric service that served rural residents who could not be reached through traditional transit modes.

## Enhance Coordination Between Local Governments and Utilities

Beyond financial assistance programs, communities can take additional measures to encourage low-income populations to purchase EVs. For instance, communities can improve and increase public charging infrastructure in disadvantaged communities through EV readiness plans. Focused informational and educational efforts on the cost and environmental benefits of EVs can be targeted to low-income areas. Jurisdictions have the opportunity to collaborate with utilities in their transportation electrification roadmaps and develop program offerings based on insights of local needs. Such coordination has led to the solutions shown below as examples.

Solution	Impact or Barrier Mitigated
Coordinate electrification roadmaps	Infrastructure & Technology
Develop utility incentive programs	Environmental Justice, Economic Considerations, Transportation Cost Burden
Develop cost-effective electricity rates for charging, such as time of use	Infrastructure & Technology, Economic Considerations, Transportation Cost Burden

## Advancing Electrification: City of Detroit and DTE Energy

Detroit City Government and DTE Energy (DTE), the local electricity provider, have partnered to drive forward sustainability efforts with a particular focus on transportation electrification. The formalized partnership consists of transportation electrification working groups co-chaired by the City and DTE. The partnership began out of a recognition that a unified approach and coordinated strategy could lead to greater impact for residents. The approach focuses on two key actions to green the City fleet and develop an EV infrastructure strategy to reduce greenhouse gas emissions.

## Measuring Success

While data analysis assists in development of solutions, it should also be used to measure the effect of implemented solutions. Key metrics that measure changes in EV equity alongside additional co-benefits should be defined and monitored in all program rollout processes. Such metrics may include:

- Quantifying EV infrastructure investment in disadvantaged communities
- Utilization rates of public charging stations
- Number of participants at educational programs targeting disadvantaged communities
- Funding allocation for disadvantaged communities
- Climate improvements and greenhouse gas reductions
- Progress on emission goals

Measuring success through data collection and measured performance metrics can be used to account for equity needs by enabling the identification of vulnerable communities, their specific needs, and appropriate solutions. Data-driven transportation electrification programs and policies that are shaped by the holistic needs and priorities of communities offer an immediate opportunity to dramatically reduce existing mobility inequities, lend significant support to decarbonization goals, and transform the existing energy framework. Recent federal announcements to transition to all-electric fleets will likely accelerate market transformation and represents an opportunity to do so equitably.

## Conclusion

The current mobility system provides much opportunity for improvement and positive actions to reduce the costs and emissions that leave the poorest Americans facing the brunt of the environmental health impacts and economic burdens. Scaling electrified transportation modes in an equitable manner is a solution that will be a tremendous benefit for low-income communities, communities of color, and vulnerable populations. Most importantly, transportation electrification is a primary method to achieve significant emissions reductions and decarbonization goals. Electric transportation modes are cleaner and more cost-effective than internal combustion-based modes, thus tackling environmental justice issues and easing the cost burden of transportation. However, numerous barriers remain to this solution, including technology limitations, inadequate electrical infrastructure, and social knowledge.

To alleviate these barriers, policy makers, utilities, and private developers have the responsibility to support innovative partnerships, enable low-cost EV markets, develop robust public charging networks, and enhance planning efforts. Data-driven modeling plays a key role in assisting such efforts by presenting holistic results and recommendations.

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### About the author



**Dr. Dana Al-Qadi's** work focuses on communities and infrastructure advanced technology and innovation. At AECOM, she manages projects on transportation electrification planning and modeling, smart city technology, decarbonization, and resilience. Much of her work includes equity considerations to reduce barriers of transportation electrification for disadvantaged communities. Her client support spans multiple sectors including utilities, planning agencies, and local governments.