AECOM

WORKING SUSTAINABLY AND TACKLING THE CLIMATE EMERGENCY

TRANSPORTATION
THE FUTURE IS ELECTRIC

Upending every aspect of life, the coronavirus pandemic presents new challenges to cities and states, including our transportation systems. As we begin to emerge and take stock of measures needed to revive our economy, AECOM's **Andrew Bui** says that a combination of stimulus-funded infrastructure and environmental factors, including public desire to hold onto the air quality benefits of lockdown, could lead to an upsurge in the number of electric vehicles on our roads.

3.1M
Number of electrified fleet vehicles (2017)

125M
Forecasted number of electic cars on the road (2030)

The shutdown and resulting economic disruption required to fight coronavirus has had a devastating impact on the economy and people's lives and livelihoods. To help them, policy makers are preparing recovery packages to support business and create jobs , the legacy of which could strengthen communities for decades to come.

Electrified transportation is likely to be a top contender for stimulus funding given its potential economic and environmental contributions — now and in the future. The number of electric cars and other personal electric vehicles on our roadways is growing exponentially each year, spurred by awareness of environmental benefits and lower costs. The number of electrified fleet vehicles rose to 3.1 million in 2017, a 54 percent increase over the past year, and the International Energy Agency forecasts that by 2030 we'll have 125 million electric cars on the road.

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Vehicles such as transit buses are at the forefront of this trend, where cities and states are taking the lead at converting their fleets.

Electric vehicles need to charge somewhere and the requirements of building a network raises complex questions for cities, states, fleet owners, and utilities. How do we adapt two separate utility and transportation networks — built over 50 years ago — to safely and securely integrate into a single and modern transportation resource? Given the increased demands and resulting investment requirements for infrastructure and energy how do we transition from our internal combustion engine present to our electrified vehicle future? How do we determine where and how to place chargers?

Electric bus

In this article, we address these questions by looking at the drivers for an electric vehicle future and the roadmap to get there.

Making the case for electric vehicles: recent drivers

Stimulus funding resulting from coronavirus recovery packages could help answer one of those questions, namely, how to fund the roll out of a charging network. The immediate connection between investing in the supportive infrastructure for transportation electrification and economic recovery is direct and essential. Simply put, it will create jobs.

Prior to the pandemic, the transition to electric vehicles was estimated to create over 200,000 new jobs by 2030, more than half related to infrastructure. Creating jobs for local workers is an impetus for cities to advance this technology.

Other advantages will be more enduring. For utilities, transportation electrification will improve their business model through an influx of new and increased electricity demand. This is a dramatic change for an industry that had seen energy needs decline over the past decade and will encourage investments in modernization and improvements. Transit agencies will invest in worker retraining and retrofits of maintenance facilities needed as a result of differences in electric vehicle operations. Reduced operations and maintenance costs resulting from transportation electrification will help advance the future of transit providing impetus to modernize antiquated systems.

Municipalities that invest in chargers and charging infrastructure in public facilities such as public buildings, airports and parking structures may use the resulting funds raised to further invest in needed infrastructure, providing a long-term means of funding modernization. Beyond the immediate jobs created with these new projects, cities and states understand the lasting legacy impact these projects will have on air quality, and ultimately the health of their communities. Improving the air quality of our communities can mean more, now than ever, as our cities look to return to a better normal from a time where we have battled a virus impacting many of those with respiratory issues.

In Los Angeles, the Transportation Electrification Partnership a collaboration between local, regional, and state stakeholders to accelerate transportation electrification and zero emissions goods movement in advance of the 2028 Olympic and Paralympic Games, is calling for $150 billion in stimulus, citing economic and public health benefits.

A growing bedrock of support

Pushed by citizen concerns, several cities across the U.S., including Los Angeles and New York, have released "green new deals" focused on carbon reduction. As a first step, these programs center around municipal vehicle electrification, incorporating transit and school buses as well as service and fleet vehicles such as garbage trucks and police vehicles.

Transit agencies are also committing to electric transportation with nine out of ten of the country's largest transit agencies studying or planning transitions by 2040. Actions are also being taken statewide. The California Air Resource Board has mandated that all buses purchased in the state after 2030 should be electric, and it's expected that all municipal buses will be electric by 2040.

Another driver is cost reductions through technology advances. A significant cost reduction in battery costs for transit vehicles improved accessibility for transit and fleet operators, sparking markets for electric buses and fleet vehicles. A Carnegie Mellon University study found that battery-electric buses are cost-competitive with liquefied natural gas, compressed natural gas, and hybrid diesel buses. But electric buses have lifecycle-cost advantages over internal-combustion engines because they covert energy into motion more effectively and have fewer moving parts, making them cheaper to power and maintain over time.

Also bolstering adoption are the vehicles' contribution to combatting climate change. Electric vehicles do not produce greenhouse gases, so widespread use reduces emissions. This is an important consideration as the transportation sector contributes 20 percent of greenhouse gases in the U.S.. Emission reduction can help cities meet social equity and environmental goals by improving air quality in lower income neighborhoods that often house vehicle terminals.

20%

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Preparing today for an electric tomorrow

The infrastructure requirements of electric vehicles affect energy and transportation networks and requires careful consideration particularly when it comes to charging infrastructure. For a successful roll-out, three areas merit attention: collaboration, energy networks and charging infrastructure.

1/ COLLABORATION

For fleet managers and businesses that operate large scale vehicle operations, a private charging network might be possible, but if individual electric car ownership is going to take off, a comprehensive charging network will be required. For that to happen, states, cities, utilities and transportation agencies need to collaborate. The responsibilities of these entities overlap in terms of their mission to improve our communities and provide public health resources. Working together these entities can develop transportation electrification strategies and prioritize public fleet conversion, infrastructure modernization, charging infrastructure planning, utility policies, rates and incentives, and energy distribution capability upgrades.

2/ ENERGY NETWORKS

Increased electric vehicle adoption will place greater demands on electric grids — and carbon credentials will come into question. Studying and modeling electrification impacts on grid assets can help authorities, agencies and other interested parties collaborate and make data driven decisions on charging infrastructure and locations, capital improvements as well as other future needs.

Managing the energy grid wisely will be increasingly important as the number of electric vehicles grows. Utilities are adapting their policies to accelerate adoption of electric vehicles by providing subsidies and in some areas, specific rates for charging. They are also trying to balance those efforts with the demand on their grid as well as their ability to support that demand.

On the flipside, electric vehicles could help utilities manage their load better, particularly given the increase in wind and solar energy generation whose power supply can be irregular. We've already seen major investments that manage this in the form of batteries that can store this energy for a few hours. Another rising technology termed vehicle to grid, can also improve load management by enabling electric vehicles' batteries to provide energy storage, taking energy off the grid and supporting the energy load. This could also generate significant revenue for transit agencies creating thousands of dollars of revenue per year. AECOM is working in Philadelphia at the Navy Yard to studying vehicle to grid and other emerging electrification [BA5] technologies that could be integrated into their emerging and growing micro-grid.

3/ CHARGING NETWORK

As electric car ownership grows, so will the need for a comprehensive public charging network. While at-home and workplace charging will play large roles in enabling infrastructure, the ability to charge on the go is another important part of the equation, particularly for larger vehicles and along longer routes and highways. Stimulus funding can help municipalities and utility operators add chargers and charger infrastructure at publicly owned areas such as parking structures or airports that can serve as linchpins for new revenue streams.

Adopting the gas station model can also support this capability. AECOM is assisting Shell Oil Company as it adds fast chargers to each of its gas stations in the Netherlands. These stations will enable drivers to charge their vehicles, pay, and drive off, reinforcing easy access to "fuel" for their vehicles.

Technologies pushing the boundaries

Even as current charging infrastructure develops, utilities and transportation agencies are continuing to advance innovations such as solid-state batteries that enable faster charging and smart systems that connect vehicles and grids which can improve grid reliability and power management.

The industry is exploring numerous new technologies to improve energy management. Among these are smart charging systems for fleet facilities which optimize charging patterns and minimize energy costs; vehicle to grid peak shaving strategies that use energy storage to reduce demand charges; microgrid technology that promotes and creates resilience; and, facility power generation that offsets power needs while providing resilience. Future technology may even include dynamic wireless charging that enables vehicles to charge on the roadway without even having to slow down.

So how long will this really take?

Over the past decade we've seen electric cars go from novelty to normal. Transit agencies are starting to make similar transitions. Transit vehicle conversion will occur gradually as buses have a 10- to 15-year useful life and transit agencies replace roughly 15 percent of buses annually. Agencies are using this lead-time to plan, particularly considering charging methods even as they work with utilities to negotiate electricity rates, but many agencies nationally have committed to being fully electric by 2040.

As with personal cars, fueling is a significant part of electric bus and fleet vehicle planning. Transit agencies have myriad charging options including catenary wires for rapid charging on-route layovers, slow charging at bus depots, or pads imbedded at bus stops that enable charging while passengers board or exit at stops or at bus depots. Selections will vary, based on energy needs related to such factors as usage, energy tariffs, route and route elevation and climate changes. While agencies will be challenged to balance charging options with operational needs and costs, those working with utility and private partners will also find opportunities to develop public-private partnership projects that can accelerate adoption.

In short, developing a comprehensive charging network is a complex and costly affair, and advancement will come in patches, likely led by fleet vehicle planning. Growing demand is likely to fuel investment, which in turn will usher in a better quality of life for communities across the United States. WL

The city of Roseville, California, is working to deliver an efficient electrified future. Roseville manages and operates its own power distribution and transportation system. Officials there collaborated with AECOM, creating a utility roadmap forecasting charging loads and supporting charging infrastructure planning and development. The city-specific study evaluated growing demand for electric vehicle charging, potential local utility impacts while forecasting electrified vehicle numbers and locations to determine business strategies and operational plans to address charging needs.

At New York City's John F Kennedy International Airport, AECOM is working with the New York Power Authority, providing program management and procurement services as well as constructability and design review as the power authority installs fully functioning electric vehicle charging stations and infrastructure at the JetBlue Terminal 5. The project will enable charging while vehicles are parked

AECOM is leading efforts with **Los Angeles Department of Transportation (LADOT)** to plan and design four of their bus facility retrofits to accommodate more than 500 new electric buses that are slated to begin conversion in 2021. Working closely with LADOT and Los Angeles Department of Water and Power (LADWP) we are designing charging infrastructure for the buses, coordinating the facilities' integration and developing smart solutions to reduce costs of fleet infrastructure conversion. Each facility anticipates about 8 megawatts of new demand and will require coordination, collaboration, and innovation to develop an effective electric transit ecosystem.