



# Powering the future of mobility

How the electric power sector can prepare for its critical role in the new transportation ecosystem

The Deloitte Center for Energy Solutions (the “Center”) provides a forum for innovation, thought leadership, groundbreaking research, and industry collaboration to help companies solve the most complex energy challenges.

Through the Center, Deloitte’s Energy & Resources group leads the debate on critical topics on the minds of executives—from the impact of legislative and regulatory policy, to operational efficiency, to sustainable and profitable growth. We provide comprehensive solutions through a global network of specialists and thought leaders.

With locations in Houston and Washington, DC, the Center offers interaction through seminars, roundtables, and other forms of engagement where established and growing companies can come together to learn, discuss, and debate.

Follow the Center on Twitter @Deloitte4Energy, and for more information, see <https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/deloitte-center-for-energy-solutions-energy-and-resources.html>.

Deloitte serves the entire ecosystem of companies working in and around mobility, and electric power companies are poised to play a critical role in that ecosystem. With its breadth of experience in working across the power and utilities value chain, Deloitte helps clients anticipate the changing landscape and take advantage of emerging opportunities by bringing an approach to executable strategy that combines deep industry knowledge, rigorous analysis, and insight to enable confident action. Deloitte’s professionals can help utility clients uncover data-driven insights to inform vision, strategy, and decision-making; transform business models to capture new growth opportunities; and apply technologies to achieve business goals. Reach out to any of the contacts listed in this article for more information.

## CONTENTS

<b>Introduction: The future is electric</b>	<b>  2</b>
<b>Have EV sales reached a tipping point?</b>	<b>  4</b>
<b>Harnessing the future of mobility to address utilities' key challenges</b>	<b>  9</b>
<b>How utilities can promote and prepare for increased EV adoption</b>	<b>  13</b>
<b>Conclusion: Utilities' role in the future of mobility</b>	<b>  17</b>
<b>Endnotes</b>	<b>  18</b>

# Introduction: The future is electric

**A**NALYSTS have long predicted that car and fleet owners would soon abandon traditional fossil-fuel-powered vehicles and go electric.<sup>1</sup> But after years of hype, promotion, and government incentives, electric vehicles (EVs) represent barely 1 percent of the market, both globally and in the United States.

And yet the optimistic forecasts might turn out to have been only a bit early, with rapid EV adoption—finally—just around the bend. Consumers are increasingly opting for electric cars, as factors such as falling prices, increasing range, and appealing incentives combine with the

“cool factor” created when exceptional design meets advanced technologies. On the horizon, the future of mobility—in particular carsharing, ridesharing, and autonomous vehicles—strongly complements EVs, further hastening adoption.

The new mobility ecosystem is arriving none too soon for the electric power industry in the United States and elsewhere. Electric companies face a variety of challenges—among them, flat electricity demand and the need to smoothly integrate a growing pool of distributed and renewable energy resources. Utilities continue to search for a “killer app” to more deeply engage customers and interest them in new products and services. A rapidly expanding EV fleet could help address each of those challenges.

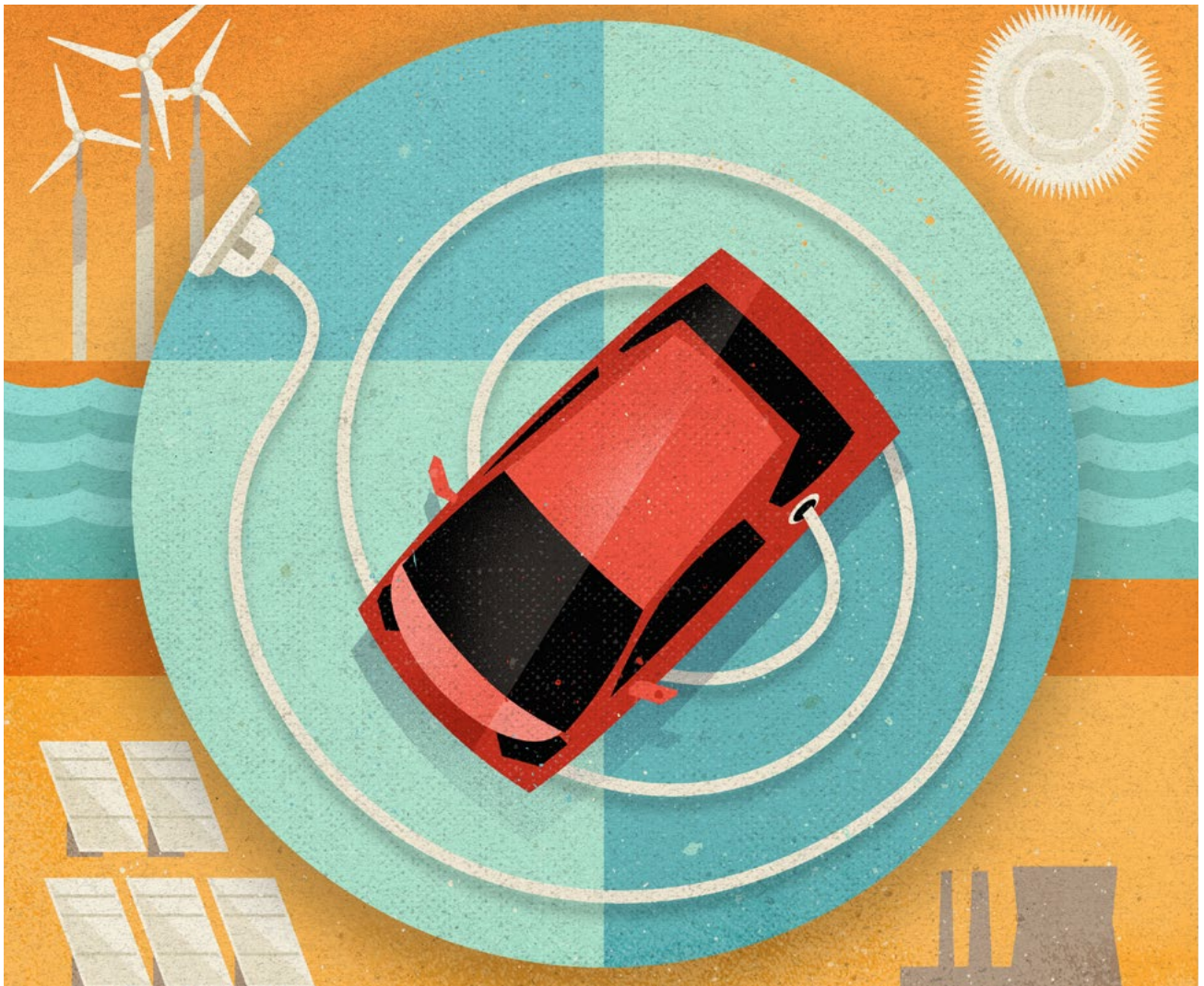
And even though other sectors are making higher-profile moves as the future of mobility becomes a reality—from groundbreaking vehicle designs<sup>2</sup> to flashy entertainment options<sup>3</sup>—electric companies need not passively wait for consumers to begin plugging in rather than filling up. To accelerate EV adoption, electric

**Utilities continue to search for a “killer app” to more deeply engage customers and interest them in new products and services.**

companies can do more to educate and incentivize customers to purchase electric cars, and they have the opportunity to become major players in the buildout of EV charging infrastructure (wired and eventually wireless). They can also brace for the increased electricity demand and changing load patterns by preparing to manage and control new EV load through smart grid technologies.

This article explores how a growing electric vehicle fleet, accelerated by other mobility trends such as shared and self-driving cars, could affect power

and utility companies' possible choices. We lay out why EV adoption may be at an inflection point, examine how the emergence of a new mobility ecosystem could create a symbiotic relationship between EVs, autonomous vehicles, and ridesharing, and look at how electric companies might turn these trends to their advantage. Last, informed by a new Deloitte survey of industry executives, we lay out some of the key steps utility executives can begin taking now to capitalize on an increasingly electric future of mobility.



# Have EV sales reached a tipping point?

CAR buyers and fleet owners across the globe are starting to give electric vehicles a second look. Why? Because new showroom arrivals have altered the initial perception of battery-powered cars as short-range, low-speed capsules. Futuristic, high-tech EVs that are fun to drive have changed consumer perceptions, with many now seeing them as the hip, desirable car of the future.<sup>4</sup> As important, plummeting battery prices have enabled automakers to introduce new, more wallet-friendly models with longer ranges.<sup>5</sup> An estimated 30–40 percent of an EV’s cost is in the lithium-ion battery pack that powers it. But those costs are falling fast, down 73 percent between 2010 and 2016 to \$273 per kilowatt-hour. Prices continue to fall due to technological improvements, manufacturing cost reductions—especially as production scales up—global manufacturing overcapacity, and competition.<sup>6</sup> At the same time, gradual buildout of charging infrastructure is helping to allay some buyers’ “range anxiety.”<sup>7</sup> And, with the projected growth of carsharing and ride-hailing services, range anxiety

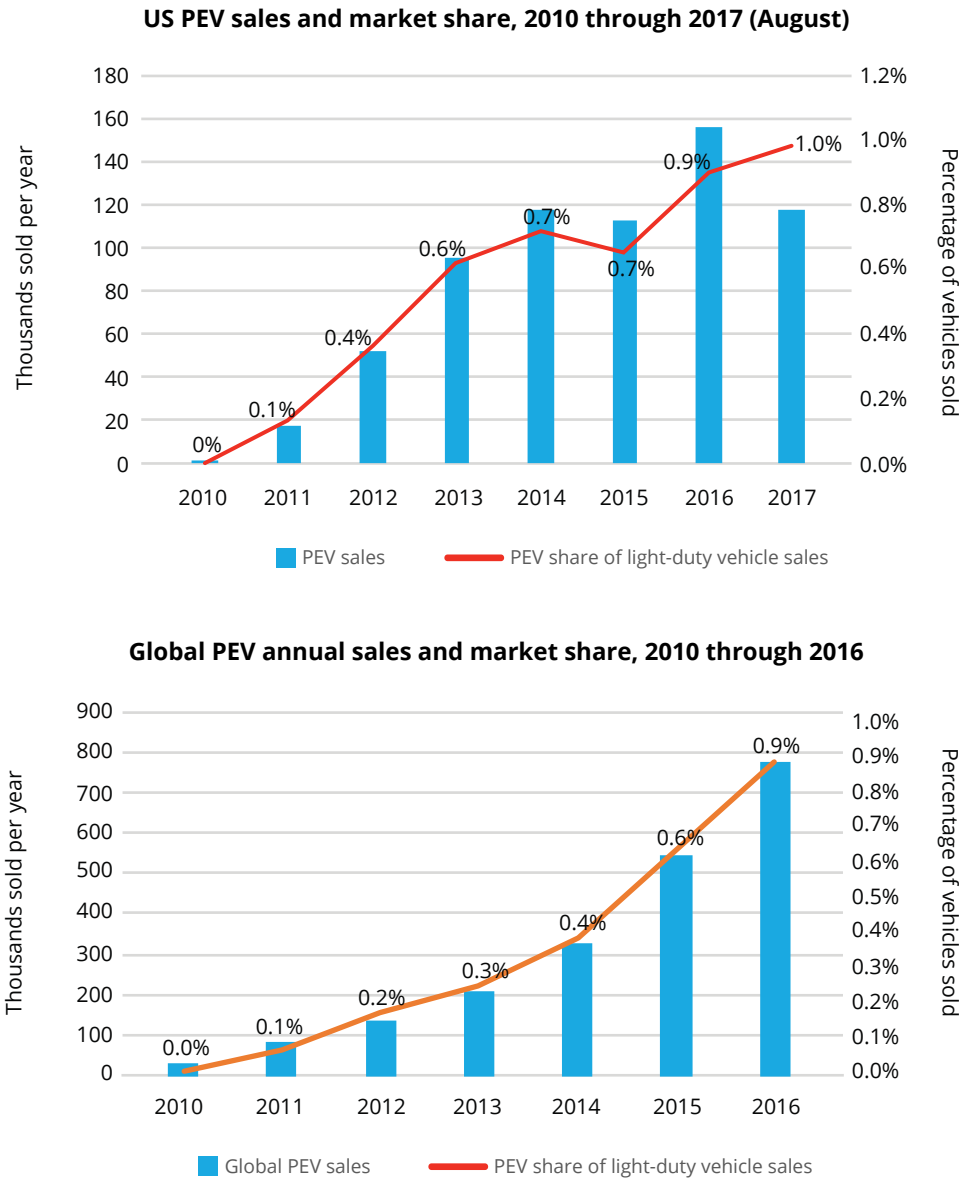
is likely to be less of a constraint for fleet management companies that can closely monitor and control EV charging.

Many governments have long incentivized EV purchases, but Norway, the United Kingdom, France, China, India, and others<sup>8</sup> have recently announced even more ambitious goals of ending or severely curtailing sales of internal combustion engine (ICE) vehicles within the next decade or two. China, with total annual car sales approaching 30 million, is working out a timetable to ban ICE vehicle sales completely.<sup>9</sup> India has set its sights on the same goal by 2030, which may be ambitious as it would require annual sales to exceed 10 million EVs, but it will likely add momentum to the global shift toward EVs.<sup>10</sup> While stopping short of banning ICE vehicles, 10 US states, citing environmental concerns, have set aggressive goals to increase EV sales.<sup>11</sup> Even if they fall short of those targets, automakers will be forced to reckon with these policies as they roll out new models, and the net effect is likely to be many more electric cars on the road.

Together, these developments are accelerating EV adoption across the globe, even as the vehicles' share of overall sales remains small (see figure 1).<sup>12</sup>

How quickly is this likely to change? Projections for US and global EV market-share growth over the next two decades vary widely, from as low as 10 per-

**Figure 1. US and global annual PEV (plug-in electric vehicle) sales and market share**



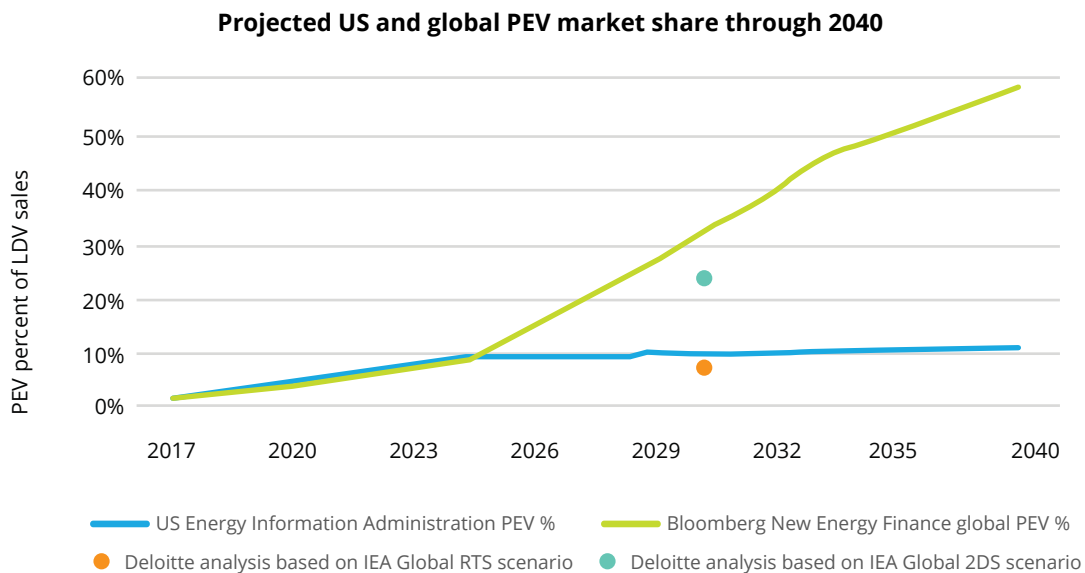
Source: Electric Drive Transportation Association, "Electric drive sales dashboard," and Jeff Cobb, "Top ten plug-in vehicle adopting countries of 2016," HybridCars, January 17, 2017.

cent to more than 50 percent by 2040 (see figure 2).<sup>13</sup> Where the actual numbers fall in the end is likely to depend on government policies to encourage EV adoption, and on the number and cost of new EV models available, as well as emerging trends in personal mobility.<sup>14</sup>

The advances in electric vehicles are part of a much broader transformation of the extended auto industry into a new mobility ecosystem (see sidebar, “What is the future of mobility?”). Critically, two of those trends—the growth of shared mobility and the emergence of self-driving vehicles—share many complementarities with electric vehicles, and may well further accelerate EV growth:

- **Reduced operating costs.** With high-utilization ridesharing fleets, EVs’ low operating costs compared with conventional ICE vehicles become an economic advantage. The growth of ridesharing and ride-hailing services will likely lead to higher utilization rates: both more miles driven and more daily road hours per car. New mobility management or mobility-as-a-service companies may own fleets of vehicles that circulate almost continuously, with or without drivers, picking up passengers who have hailed them, typically through smartphone apps. Autonomous ride-hailing vehicles may be used about 40 percent of the day, compared with less than

**Figure 2. Projected PEV share of total light-duty vehicle sales**



The IEA’s Reference Technology Scenario (RTS), projecting 56 million electric cars in circulation by 2030, reflects projections that respond to policies on energy efficiency, energy diversification, air quality, and de-carbonization that have been announced or are under consideration. The IEA’s 2DS scenario, projecting 160 million EVs in circulation by 2030, occurs in a context consistent with a 50% probability to limit the expected global average temperature increase to 2°C. We estimated annual sales required to meet IEA’s EV stock projections for 2030 and then calculated the EV share of sales as a percent of total light-duty vehicle sales projected by Bloomberg New Energy Finance for 2030.

Source: Deloitte analysis.



5 percent for privately owned vehicles.<sup>15</sup> And research shows that the more miles a car drives in its lifetime, the more economical it is to drive electric due to the lower costs of charging relative to refueling and the reduced maintenance expenses that accompany simpler construction.<sup>16</sup>

- **Autonomous technology integrates better with electric engines.** Electric cars are easier for computers to drive—indeed, most EVs are built with drive-by-wire systems that replace traditional mechanical control systems with electronic controls, and these systems create a more compatible and flexible platform for autonomous driving technologies. In addition, EV battery packs contain higher voltages than typical ICE vehicle batteries, which enable them to accommodate more self-driving features. While engineers can make gasoline-powered cars autonomous, automakers and technology companies have largely chosen EVs—with far fewer moving parts—for their self-driving vehicle prototypes.<sup>17</sup>
- **Safety and design simplicity.** If a self-driving ICE vehicle pulled up to the gas pump, it would likely need human assistance to fill the

tank; recharging a driverless EV would likely be easier and safer. While EV manufacturers have been developing automated chargers that would plug into self-driving cars, the industry generally expects that wireless charging, which some automakers are already bringing to market, will be the more likely solution.<sup>18</sup> A self-driving EV could navigate to the nearest wireless charging pad (or utilize in-road charging infrastructure), park itself, charge, and then drive away—or even charge itself while waiting at a traffic light or to pick up a passenger. Automakers see wireless charging as a convenience that will likely help increase electric vehicle adoption.

Early prototypes and pilot programs of ride-sharing autonomous vehicle services are already heavily favoring EVs. For example, General Motors designed its Bolt EV specifically for ridesharing and mobility services, according to GM’s executive chief engineer of autonomous tech.<sup>19</sup> Ridesharing service Lyft, which is partnering with several automakers, aims to provide at least 1 billion rides per year using electric autonomous vehicles by 2025, and to power those cars with “100% renewable energy.”<sup>20</sup>

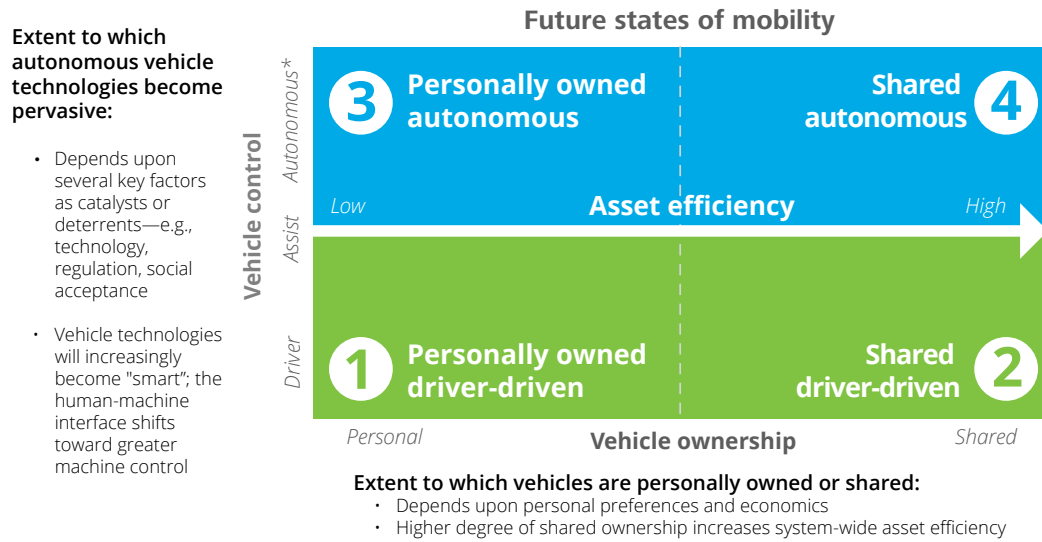
## The advances in electric vehicles are part of a much broader transformation of the extended auto industry into a new mobility ecosystem.

### WHAT IS THE FUTURE OF MOBILITY?

Deloitte's *Future of Mobility* research suggests that the convergence of a series of forces is transforming the way people and goods move from point A to point B.<sup>21</sup> These include maturing powertrain technologies, innovations in lightweight materials, advances in connected vehicle technology, shifts in personal mobility preferences, and the emergence of autonomous vehicles.

The confluence of these forces is fueling the emergence of a new mobility ecosystem encompassing four concurrent future states, defined by who owns and who operates the vehicle (see figure 3).

**Figure 3. The future states of mobility**



\*Fully autonomous drive means that the vehicle's central processing unit has full responsibility for controlling its operation and is inherently different from the most advanced form of driver assist. It is demarcated in the figure above with a clear dividing line (an "equator").

Source: Deloitte analysis.

Deloitte Insights | [deloitte.com/insights](https://deloitte.com/insights)

- **Future state 1: Personally owned driver-driven.** In this future state, private car ownership is the norm. While many vehicles incorporate driver-assist technologies, this state assumes that consumers do not widely adopt fully autonomous vehicles.
- **Future state 2: Shared driver-driven.** The second future state assumes continued growth of shared access to vehicles through ridesharing and carsharing. Economic scale and increased competition drive the expansion of shared vehicle services into new geographic territories and more specialized customer segments.
- **Future state 3: Personally owned autonomous.** In this state, autonomous drive technology proves viable, safe, convenient, and economical—yet private ownership prevails. Drivers prefer owning their own vehicles but seek driverless functionality for its safety and convenience.
- **Future state 4: Shared autonomous.** The fourth state sees the convergence of both the autonomous and vehicle-sharing trends. Mobility management companies and fleet operators offer a range of passenger experiences to meet widely varied needs at differentiated price points. Taking off first in urban areas but spreading to the suburbs, this future state provides seamless mobility between transportation modes.

Compelling economics in future state 4 suggest a shift over time toward a world of shared autonomous fleets. Deloitte's forecast indicates more than half of the road miles traveled in the United States by 2040 could be in shared self-driving vehicles.<sup>22</sup>

# Harnessing the future of mobility to address utilities' key challenges

**F**URTHER acceleration of EV adoption could help electric companies reverse or reap opportunities from three of today's biggest challenges: stagnant demand, the requirement to integrate renewable and distributed energy resources seamlessly, and the need to engage customers and interest them in new services.

## EV adoption can potentially reverse stagnating electricity demand

Electric cars will “upend the idea of no load growth,” according to EnergyHub cofounder Seth Frader-Thompson.<sup>23</sup> In the United States and many other developed countries, electricity demand stopped increasing in tandem with GDP in the past several years, thanks to energy efficiency standards, technological improvements, stricter state and local building energy codes, and a shift in the economy to less energy-intensive industries.<sup>24</sup>

For the electric power industry, EVs offer a glimmer of light—though projections for EV-generated

rises in electricity demand vary as widely as EV adoption projections themselves. Bloomberg New Energy Finance, among the most aggressive forecasts, projects electricity consumption from EVs to rise 300-fold globally, from 6 terawatt-hours (tWh) in 2016 to about 1,800 tWh in 2040. Electricity consumption from EVs would then comprise about 5 percent of total 2040 global consumption.<sup>25</sup>

This additional demand is unlikely to strain electricity generation and transmission resources in most developed countries. In the United States, the Department of Energy's Pacific Northwest National Laboratory calculated that the electric grid currently has enough excess capacity to support more than 150 million EVs.<sup>26</sup> However, utilities may need to plan for distribution system upgrades in areas with particularly high EV adoption. And the smart meters, analytics, and automation systems that utilities are deploying through grid modernization programs will be critical to help shape and manage growing EV load. Overall, many see managed EV charging as a potential benefit to the grid and an increasingly important resource.

## In urban areas, where fleets of shared electric autonomous vehicles are likely to be concentrated, it will be even more important for utilities and fleet owners to coordinate, plan, and manage vehicle charging.

Although overall electricity demand is trending flat to lower, it's also becoming "peakier" in many developed countries. In other words, power demand during peak periods, often in the mid-afternoon or early evening, is rising. Without incentives to charge during off-peak hours, growing EV adoption could exacerbate this challenge, since many owners would presumably return home each day around the same time and plug in their cars during the early evening peak demand period. That's why many utilities have deployed or are developing time-of-use and EV rate plans that sharply reduce electricity prices during off-peak periods, such as late evening, to help shift EV load to off-peak hours. Some are also exploring managed charging options, as discussed below.<sup>27</sup> In urban areas, where fleets of shared electric autonomous vehicles are likely to be concentrated, it will be even more important for utilities and fleet owners to coordinate, plan, and manage vehicle charging.

### EVs: A key grid management tool

The rise of electric cars could do more for utilities than simply increase demand—EVs might well help balance and fine-tune electricity supply and demand on the grid. As peak demand levels rise, electric companies must either build or acquire more generation capacity, store power using batteries or other technologies, or purchase power from other suppliers at peak prices. But some are beginning to see the growing fleet of EVs as a powerful

load management resource for adding critical flexibility to the grid.

An EV is essentially "a large battery on wheels," says Val Miftakhov, CEO of EV charging technology company eMotorWerks. "It's a cheaper way for utilities to deploy energy storage, with zero capital cost and zero operating costs."<sup>28</sup> Utilities can modulate the power flows between the grid and EVs to help balance electricity supply and demand and improve power quality. For example: At midday, when the sun is strongest, or during windy nights, idle EVs could absorb excess supply, so generators don't have to curtail production. Similarly, when clouds roll in or the wind dies down, the grid could draw power from EV batteries to compensate for reduced power generation, provided technology and market structures support such services.

Such grid interactions are facilitated by "smart" technologies that enable EV/grid communications: EV owners or fleet or charger owners enter parameters, such as when they'll need to use the car(s), and utilities send price signals and initiate demand response events that they or third parties implement remotely within the users' parameters. EV grid services can be vehicle-to-grid (V2G) or V1G, a term derived from V2G to describe a more preliminary phase of EV/grid interaction. V2G services involve power flows from the EV to the grid, while V1G services, or managed charging, involve adjusting the amount of power the vehicle pulls while charging, in response to signals from the grid.<sup>29</sup> EV batteries, with their fast start-and-stop capabilities, are a good source for providing ancillary or regulat-

ing services that help maintain power quality and balance the grid, such as voltage regulation, voltage support, frequency regulation, and ramp rate reduction. Even during peak driving times and before widespread wireless charging is implemented, there are likely to be sufficient numbers of parked and charging vehicles to make them a valuable tool for utilities.

While these services are still largely being tested in pilots, EV fleet owners in Denmark are already collecting €1,300 (about \$1,530) per vehicle per year for feeding power back to the grid through a pilot program managed by Nissan Motor Co. and the Rome-based multinational power company Enel SpA.<sup>30</sup> “We consider integration with electric vehicles a cornerstone of the future of the electric system, as they now have become far more than mobility solutions,” said Enel’s chief innovation officer, Ernesto Ciorra, when the project began in 2015.<sup>31</sup>

In areas where these services are not yet deployed, it’s typically because there are still too few EVs on the local grid or because regulators, grid operators, utilities, and other stakeholders are still developing standards, rules, and market and regulatory structures. It’s a challenge to assign value to all of the services that an EV or any other distributed energy resource can provide and ensure owners are appropriately compensated, and even more so in areas that lack wholesale electricity markets.

If new transportation and mobility providers emerge in urban areas with large fleets of electric vehicles, as current trends suggest, these providers will be well positioned to coordinate with electric utilities to provide sophisticated grid services for mutual benefit. In addition, as medium- and heavy-duty vehicles such as delivery vans, transit, and school buses are electrified, private and municipal fleet owners will be poised to provide services to the grid and derive value from them. Payments provided for these services could help defray the vehicles’ costs, further accelerating adoption.

## EVs may, at last, help utilities engage customers

The electric power industry has long searched for a killer app to help engage customers. Utilities seek to increase customer participation in programs such as demand response to help save costs, and to sell them new products and services, such as solar, storage, and microgrid installation and maintenance, that could boost revenue. This is particularly true in the current period of industry transformation ushered in by slow demand growth, the high cost of upgrading aging infrastructure and digitizing the grid, and competition from new market entrants and technologies, such as distributed solar.

---

**Could widespread EV adoption finally compel residential, commercial, and industrial electricity customers to become more active participants in the emerging energy ecosystem? Maybe so, once they begin amassing credits on their utility bills in payment for EV services provided to the grid.**

---

So far, electricity customers have been slow to engage. Deloitte's *Resources 2017 Study* shows that Millennials are more interested in adopting new technologies and engaging with utilities than previous generations, particularly via social media, so engagement may gradually increase.<sup>32</sup> But could widespread EV adoption finally compel residential, commercial, and industrial electricity customers to become more active participants in the emerging energy ecosystem? Maybe so, once they begin amassing credits on their utility bills in payment for EV services provided to the grid.

Companies such as Fleetcarma are working with utilities to engage customers with a turnkey EV charging incentive program. Owners of individual EVs or fleets can access an app and portal that provide advanced statistics from their vehicles and join a rewards program that helps them better understand their driving/charging patterns, and redeem rewards through a user dashboard. They can

also join EV owner communities and compare their own stats and experiences with other owners.<sup>33</sup> Customer engagement in EV programs could lead to increased interest in new utility services.

If mobility service providers with large EV fleets begin to emerge, they will likely coordinate closely with utilities and EV charging equipment providers to understand optimal locations and charging platforms to deploy for maximum interoperability with the grid, as well as available rate plans and services they can provide to the grid. They may also be interested in utility "green power" plans or in purchasing solar, stationary storage, and microgrid assets and services for reliability and cost savings. Utilities could potentially own and lease EV batteries to fleet owners, or fleet owners could sell EV batteries back to utilities once their capacity declines to 70–80 percent, when they're no longer useful in vehicles but can be deployed for less-intensive, stationary storage applications on the grid.<sup>34</sup>

# How utilities can promote and prepare for increased EV adoption

**U**TILITIES have an interest in seeing increased EV adoption. The first step they can take toward realizing this vision, which many have already taken, is to educate customers about the benefits of EV ownership. Utility programs may also include discounts and rebates on leased or purchased electric cars or charging equipment, free charger installation, financing, and special off-peak rate plans for owners.

## Invest in EV charging infrastructure

Estimates vary widely, but the cost to build out charging infrastructure for the predicted EV fleet through 2040 may well reach into the hundreds of billions of dollars globally.<sup>35</sup> Wireless charging, which would be installed in roads and parking lots, could require substantially more investment.

Given the sizable gap between current charging infrastructure and what's needed to support growing EV adoption—and EVs' potential benefits for electric companies and their customers—utilities

should consider playing a larger role in building out this infrastructure. And their regulators and boards should support it. In California, Europe, and elsewhere, that is beginning to happen.

So far, public charging infrastructure has been built out and funded by several sectors, including automakers, EV equipment suppliers, retailers, real estate companies, and federal, state, and municipal governments. In Europe and China, power companies and distribution system operators have built a substantial amount of public EV charging infrastructure, while in the United States, participation is in its early stages.<sup>36</sup> Utilities are well suited to the task, thanks to their generally strong balance sheets, access to low-cost capital, and experience building large-scale infrastructure. Some US regulated utilities also have the potential to include investments in rate base and earn a regulated rate of return.

Regulation has been one constraint on greater US utility involvement in building public charging infrastructure, but the overall benefits that EVs can provide to the electric grid are beginning to soften that resistance. Some state utility commissions have hesitated to allow electric companies to recov-

er these costs, seeing charging stations as a benefit to some but not all utility customers. In addition, some regulators believe that allowing cost recovery and a rate of return would provide an unfair competitive advantage for electric utilities over other infrastructure providers. But the expansion of EVs and the potential benefits to all electricity customers in terms of reliability, affordability, and environmental gains from widespread adoption diminishes these arguments and highlights the crucial role of utilities.

In the United States, the California Public Utilities Commission banned the state's investor-owned utilities from investing in EV charging infrastructure in 2011 due to the aforementioned concerns. But in 2014, the commission reversed the ban, and, in 2016, it approved \$197 million of investment in light-duty vehicle charging infrastructure by the state's three largest investor-owned utilities—and it is currently considering utility plans for more than \$1 billion in infrastructure buildout.<sup>37</sup> California policy makers, like their European counterparts, realize they cannot meet ambitious emission-reduction goals without targeting the transport sector by promoting EV growth. And consumers will not purchase electric cars if charging infrastructure is not deemed adequate.

The pending California charging infrastructure requests go much further than the original round of investments—proposing to build not only residential and public light-duty vehicle chargers but also direct-current fast chargers and chargers for medium- and heavy-duty vehicles such as delivery trucks, buses, and port transportation vehicles. The utilities have also requested cost recovery for EV awareness campaigns and incentives for auto dealers and ride-hailing services to purchase EVs. Utility planners clearly have their eyes on future mobility trends and are seeking to pave the way. As these cases move through the California Public Utilities Commission, other utilities and regulators across the country are watching. Commissions in a few other states have agreed to allow regulated utilities to recover costs of EV charging infrastructure investment, while re-

quests in some states, particularly in the Midwest, have been denied so far or are under further investigation.

“Everyone benefits from reduced emissions and clean air associated with transportation electrification,” says San Diego Gas & Electric spokesman Hanan Eisenman. “In addition, these projects will help encourage off-peak charging that avoids the need to build more power plants.” SDG&E's plan, Eisenman adds, would ultimately increase the number of EVs on the road, optimize the regional power grid, and lower costs in the long run.<sup>38</sup>

## Prepare to manage load and support emerging transportation service providers

If utilities are able to shape and manage the load as EVs are added to the grid, the vehicles would become a powerful resource that can add flexibility and resilience while enabling EV owners to derive additional value from their vehicles. To unlock these benefits, utilities can take a variety of steps:

- **Develop rate plans that incentivize off-peak charging.** Utilities should consider designing electricity rates that encourage customers (both households and fleets) to charge EVs during off-peak hours, if they have not already done so. Many already offer residential time-of-use rate plans that discount electricity use during off-peak hours, usually late at night. Some also offer EV rate plans that bill electricity through a separate meter at a different rate than electricity used by the rest of the home. These plans also encourage off-peak charging, and rates in both types of plans may vary seasonally, typically rising during the summer. Fifty-nine percent of respondents in a recent Deloitte survey of executives from investor-owned, cooperative, and municipal electric utilities who are involved in their utilities' EV initiatives said their companies offer time-of-use or EV rate plans or plan to in the



future, while 26 percent said they are studying them or awaiting regulatory approval.<sup>39</sup>

- **Identify EV owners and educate them about special rate plans.** Of course, incentive plans are of limited value if customers are unaware of them—or if companies are unable to identify the relevant customers in the first place. Overall, 41 percent of survey respondents said they lack information about which customers own EVs or where those EVs are located in their service areas; another 41 percent said they have information, but

it is not comprehensive. Notifications from customers who have purchased or leased EVs, state departments of motor vehicles, car dealerships, and local governments that have issued permits for home charging equipment are all potential sources of information. Analytics can also detect an EV's "footprint" based on electricity usage in the household.

- **Offer "green charging" plans, where possible.** Renewable energy sources appeal to many EV owners. In fact, studies show that 28–40 percent of EV owners in the United States and Europe also have home solar, compared with about 1 percent solar penetration among the general population.<sup>40</sup> Utilities in areas that generate excess renewable energy during off-peak hours can offer customers low rates to charge zero-emission vehicles with "green" power during this period. For example, Minnesota-based Great River Energy allows member customers to fuel their EVs with 100 percent wind energy at no additional cost above standard and off-peak rates.<sup>41</sup>

Utilities are well suited to the task of building out charging infrastructure, thanks to their generally strong balance sheets, access to low-cost capital, and experience with large-scale projects.

- **Develop smart charging solutions to shape load.** Increasingly sophisticated charging communications and control technologies are available to help monitor EV battery usage and charging patterns and provide other functions that can optimize value to the owner and the grid. These may include enabling individual EV or fleet owners to set charging preferences, adjust or override them, receive price signals and grid support requests from utilities and respond to them—automatically or manually—

and receive notifications of their vehicles' state of charge. While these technologies are developing rapidly, EV charging ecosystem participants (for example, utilities, EV supply equipment providers, automakers, and technology companies) are still working through challenges related to communications standards and interoperability. Just 21 percent of the utilities Deloitte surveyed said they provide home or public charging stations that are smart-grid-enabled. Another 12 percent said they

plan to provide chargers with this capability in the future, while 47 percent of respondents do not provide charging equipment. Utilities that do not offer charging equipment can coordinate with EV supply equipment and smart-charging platform providers to provide these capabilities, even if customers do not have smart meters.

- **Develop new grid services.** Utilities can identify new services that EVs can provide and work with ecosystem participants to develop new market structures to offer them. They can coordinate with EV supply equipment providers and charging aggregators, automakers, regional

electricity system operators, and regulators, where applicable, to develop market structures that enable delivery of, and payment for, demand response, ancillary services, and other benefits to utilities and grid operators. More than 44 percent of utility respondents in the Deloitte survey sample said they are planning to incorporate EV charging into their demand response programs; 6 percent said they have already done so. Others are awaiting further EV penetration, smart meter deployment, or additional technological capabilities.

- **Work with fleet owners, cities, and emerging mobility providers.** Utilities should continue to work with fleet owners and look for opportunities to coordinate with smart-city planners and emerging mobility service providers. Utilities in urban and high EV adoption

areas should consider coordinating with fleet owners and governments to encourage electrification of delivery vans, urban buses, emergency vehicles, and other fleet vehicles. Perhaps most importantly, utilities should monitor existing and emerging mobility service providers (ride-hailing, ridesharing, and carsharing services), offer incentives for EV adoption, and consider how to shape future load management. Power companies can look to develop mutually beneficial programs for fleets to deliver and be compensated for grid services that may reduce or defray costs of EVs, chargers, and charging while providing resources to the grid where and when it is most beneficial. They can also explore opportunities around vehicle battery management, leasing, and recycling.



# Conclusion: Utilities' role in the future of mobility

IT'S too early to say for certain that electric cars, as part of the emerging mobility ecosystem, will save the day for electric utilities. But there's little question that change is already happening, and developments not only leave room for power companies to play a role—their role will be integral to the future of mobility.

With the predicted rise of EVs—increasingly affordable, road-trip-worthy, and even cool—the electric power industry may finally get a foot in the door of the coveted transportation sector, with EVs providing new demand for electricity during the power industry's ongoing transformation. What's more, EVs and their onboard batteries can potentially help

utilities solve a range of longstanding challenges: balancing the grid, integrating new variable and distributed resources, improving operating efficiency, and reducing costs for all customers. Electric cars may even spark a degree of customer engagement that utilities rarely enjoy, helping them launch an array of new products and services.

If executives begin to act now—by educating and incentivizing EV purchases, building out charging infrastructure, and preparing to manage EV load—the electric power sector can help enable this future and secure its own role powering the emerging mobility ecosystem, while increasing value for customers and shareholders.

## ENDNOTES

1. Dominic Hofstetter, "All your forecasts are wrong: How many EVs will be on the road by 2015?", Greentech Media, October 17, 2011.
2. Neal Ganguli, Chris Burns, and Ryan Goldsberry, *Supplying the future of mobility*, Deloitte University Press, October 17, 2016.
3. Greg Merchant, Dan Schlaff, and Derek M. Pankratz, *Experiencing the future of mobility*, Deloitte University Press, August 17, 2017.
4. Dan Neil, "Want a car that goes crazy fast? Go electric," *Wall Street Journal*, August 3, 2017.
5. Kyle Field, "How does the Chevy Bolt compare to the Tesla Model 3?", CleanTechnica, June 20, 2017.
6. US Department of Energy, "Cost and price metrics for automotive lithium-ion batteries," February 2017, p. 2.
7. Zachary A. Needell, James McNerney, Michael T. Chang, and Jessika E. Trancik, "Potential for widespread electrification of personal vehicle travel in the United States," *Nature Energy* 1, August 15, 2016.
8. Alanna Petroff, "These countries want to ditch gas and diesel cars," CNN, July 26, 2017; Sherisse Pham, "China wants to ban gas and diesel cars," CNN, September 11, 2017.
9. Pham, "China wants to ban gas and diesel cars."
10. Saket Sundria, "India's 2030 all-electric car target seen 'ambitious' by IEA," Bloomberg, May 1, 2017, updated May 12, 2017.
11. Union of Concerned Scientists, "What is ZEV?," last revised October 31, 2016.
12. Electric Drive Transportation Association, "Electric drive sales dashboard," accessed September 20, 2017; Jeff Cobb, "Top ten plug-in vehicle adopting countries of 2016," HybridCars, January 17, 2017.
13. US Department of Energy, Energy Information Administration, "Light-duty vehicle sales by technology type," accessed September 20, 2017; International Energy Agency, *Global EV Outlook 2017*, June 2017, pp. 22-23, 25; Bloomberg New Energy Finance, "Electric vehicle outlook 2017 executive summary," July 2017; Grantham Institute, *Expect the unexpected: The disruptive power of low-carbon technology*, February 2017, p. 23; BP, *BP Energy Outlook 2017 Edition*, p. 47, accessed September 20, 2017.
14. International Energy Agency, *Global EV Outlook 2017*, p. 7.
15. Greg Gardner, "The self-driving revolution will be mostly electric," *Detroit Free Press*, September 18, 2016.
16. Tom Moloughney, "How much does it cost to charge an electric car?," Plug In America, November 2016; Brad Berman, "Total cost of ownership of an electric car," Plug In America, November 8, 2016.
17. Cosmin Laslau, "Six reasons why electric vehicles and autonomous vehicles will inevitably merge," Lux Research Inc., September 9, 2016.
18. Ibid.
19. Cadie Thompson, "GM will use Lyft to launch its first self-driving car," *Business Insider*, July 18, 2016.
20. John Zimmer and Logan Green, "Lyft climate impact goals," June 15, 2017.

21. Scott Corwin, Joe Vitale, Eamonn Kelly, and Elizabeth Cathles, *The future of mobility*, Deloitte University Press, September 24, 2015.
22. Scott Corwin, Nick Jameson, Derek M. Pankratz, and Philipp Willigmann, *The future of mobility: What's next?*, Deloitte University Press, September 14, 2016.
23. Seth Frader-Thompson, presentation at panel "Exploring the capabilities of distributed energy resources," 2017 Grid Evolution Summit, Smart Electric Power Alliance, Washington, DC, July 27, 2017.
24. US Department of Energy, Energy Information Administration, "Electricity data browser: Net generation for all sectors"; Federal Reserve Bank of St. Louis Economic Research, "Real gross domestic product," accessed August 2017; Katherine Tweed, "US electricity demand flat since 2007," *IEEE Spectrum*, February 6, 2015.
25. Bloomberg New Energy Finance, "Electric vehicle outlook 2017," accessed September 20, 2017.
26. Per Christian Honningsvaag, "The global shift toward electric vehicles," Microsoft, July 6, 2016.
27. Erika Meyers, "Beyond load growth: The EV managed charging opportunity for utilities," Smart Electric Power Alliance, March 23, 2017.
28. Val Miftakhov, presentation at panel "Exploring the capabilities of distributed energy resources," 2017 Grid Evolution Summit, Smart Electric Power Alliance, Washington, DC, July 27, 2017.
29. Meyers, "Beyond load growth."
30. Jess Shankleman, "Parked electric cars earn \$1,530 from Europe's power grids," Bloomberg, August 11, 2017.
31. *Automotive World*, "Nissan and ENEL team up to transform electric vehicles into mobile energy sources," December 8, 2015.
32. Marlene Motyka, Scott Smith, and Andrew Slaughter, *Deloitte resources 2017 study: Energy management sustainability and progress*, 2017, p. 16.
33. Fleetcarma, "SmartCharge rewards," accessed September 20, 2017.
34. Julian Spector, "The road to a thriving second-life EV battery market," Greentech Media, September 7, 2016.
35. Based on Deloitte analysis using projections for light-duty electric vehicle stocks from sources noted in endnote 10, and vehicle-to-charger ratios and costs (capital and installation) from the National Renewable Energy Laboratory, *National economic value assessment of plug-in electric vehicles*, Volume 1, December 2016, p. 19.
36. International Energy Agency, *Global EV Outlook 2017*, p. 36.
37. Michelle Melton, "Utility involvement in electric vehicle charging infrastructure: California at the vanguard," Center for Strategic and International Studies, April 6, 2016; Herman K. Trabish, "How California's utilities are planning the next phase of electric vehicle adoption," *Utility Dive*, February 7, 2017.
38. Rob Nikolewski, "California utilities propose a \$1 billion electric vehicle push," *San Diego Union-Tribune*, January 24, 2017.
39. Deloitte conducted a survey of electric utility executives between June and August 2017 to explore the actions they are taking to provide EV charging infrastructure and prepare for increased load from electric vehicles. The 34 utility respondents were employees of investor-owned (44%), cooperative (41%), and municipal (15%) utilities.
40. Zachary Shahan, "28-40% of EV drivers have solar panels," CleanTechnica, June 25, 2017.
41. Great River Energy, "Revolt," accessed September 20, 2017.

## ABOUT THE AUTHORS

### Scott Smith

**Scott Smith** is vice chairman and US Power & Utilities leader for Deloitte LLP, as well as the Audit Energy & Resources leader for Deloitte & Touche LLP. He is an audit partner with more than 26 years of public accounting experience working with power and utility clients throughout the United States and Europe. He is on LinkedIn at [www.linkedin.com/in/scott-smith-363b09143/](http://www.linkedin.com/in/scott-smith-363b09143/) and on Twitter @ScottGibbsSmith.

### Suzanna Sanborn

**Suzanna Sanborn** is a senior manager in the Deloitte Center for Energy Solutions, where she analyzes global energy trends, with a focus on the power and utilities and renewable energy sectors. She has more than 20 years of experience in research, analysis, marketing, communications, and program management in the power and utilities, oil and gas, and renewable energy sectors. Suzanna is on LinkedIn at [www.linkedin.com/in/suzanna-sanborn-510164/](http://www.linkedin.com/in/suzanna-sanborn-510164/) and on Twitter @SuzannaSanborn.

### Andrew Slaughter

**Andrew Slaughter** is executive director of the Deloitte Center for Energy Solutions, working closely with Deloitte's Energy & Resources leadership to define, implement, and manage the execution of the Center strategy, develop and drive energy research initiatives, and manage the development of the Center's eminence and thought leadership. He is on LinkedIn at [www.linkedin.com/in/slaughterandrew/](http://www.linkedin.com/in/slaughterandrew/).

## ACKNOWLEDGEMENTS

The authors would like to thank the utility executives, charging equipment providers, and other industry experts who shared their perspectives with us for this article. And a special thanks to the Smart Electric Power Alliance, the Edison Electric Institute, the National Rural Electric Cooperative Association, and the American Public Power Association for their advice and efforts to increase participation in our utility survey.

In addition, we would like to thank **Kartikay Sharma** of Deloitte Support Services India Pvt. Ltd and **Tom Kinrade** of Deloitte Consulting LLP for their research and analytical support; **Scott Corwin** of Deloitte Consulting LLP and **Derek Pankratz** of Deloitte Services LP for their help shaping the perspectives in this article; and **Matthew Budman** of Deloitte Insights for his editorial guidance.

## CONTACTS

**Scott Smith**

Vice chairman  
US Power & Utilities leader  
Deloitte LLP  
+1 619 237 6989  
ssmith@deloitte.com

**Andrew Slaughter**

Managing director  
Deloitte Center for Energy Solutions  
Deloitte Services LP  
+1 713 982 3526  
anslaughter@deloitte.com

**Scott L. Corwin**

Managing director  
Strategy & Business Transformation  
Deloitte Consulting LLP  
+1 212 653 4075  
scottcorwin@deloitte.com

**Philipp Willigmann**

Senior manager  
Strategy  
Monitor Deloitte  
Deloitte Consulting LLP  
+1(347) 549-2804  
phwilligmann@deloitte.com

**Suzanna Sanborn**

Senior manager  
Deloitte Center for Energy Solutions  
Deloitte Services LP  
+1 703 251 1930  
ssanborn@deloitte.com

**Brian Murrell**

Principal  
Advisory Power & Utilities leader  
Deloitte & Touche LLP  
+1 914 462 6113  
bmurrell@deloitte.com

**Reid Miller**

Principal  
US Power & Utilities Consulting leader  
Deloitte Consulting LLP  
+1 612 747 5474  
remiller@deloitte.com

# The future of mobility



Breakthroughs in self-driving cars are only the beginning: The entire way we travel from point A to point B is changing, creating a new ecosystem of personal mobility. Our in-depth collection of research and multimedia provides insight into how this shift will affect far more than automakers—industries from insurance and health care to energy and media should reconsider how they create value in this emerging environment.

## Understand the ecosystem



### The future of mobility

How transportation technology and social trends are creating a new business ecosystem



### The future of mobility: What's next?

Tomorrow's mobility ecosystem—and how to succeed in it



### Toward a mobility operating system

Establishing a lingua franca for urban transportation

## Dive deeper into key topics

- Behavioral economics of adoption
- Cyber security
- Consumer attitudes
- Mobility-as-a-service
- New business models
- Smart cities
- Workforce implications

## Explore industry perspectives

- Auto retail, suppliers, and finance
- Insurance
- Media
- Oil & gas
- Power & utilities
- Shipping/freight
- Telecom
- US Government



# Deloitte.

## Insights

Sign up for Deloitte Insights updates at [www.deloitte.com/insights](http://www.deloitte.com/insights).



Follow @DeloitteInsight

### Contributors

**Editorial:** Matthew Budman and Nikita Garia

**Creative:** Kevin Weier and Mahima Nair

**Promotion:** Devon Mychal

**Artwork:** Dieter Braun

### About Deloitte Insights

Deloitte Insights publishes original articles, reports and periodicals that provide insights for businesses, the public sector and NGOs. Our goal is to draw upon research and experience from throughout our professional services organization, and that of coauthors in academia and business, to advance the conversation on a broad spectrum of topics of interest to executives and government leaders.

Deloitte Insights is an imprint of Deloitte Development LLC.

### About this publication

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or its and their affiliates are, by means of this publication, rendering accounting, business, financial, investment, legal, tax, or other professional advice or services. This publication is not a substitute for such professional advice or services, nor should it be used as a basis for any decision or action that may affect your finances or your business. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser.

None of Deloitte Touche Tohmatsu Limited, its member firms, or its and their respective affiliates shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

### About Deloitte

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. In the United States, Deloitte refers to one or more of the US member firms of DTTL, their related entities that operate using the "Deloitte" name in the United States and their respective affiliates. Certain services may not be available to attest clients under the rules and regulations of public accounting. Please see [www.deloitte.com/about](http://www.deloitte.com/about) to learn more about our global network of member firms.

Copyright © 2017 Deloitte Development LLC. All rights reserved.  
Member of Deloitte Touche Tohmatsu Limited