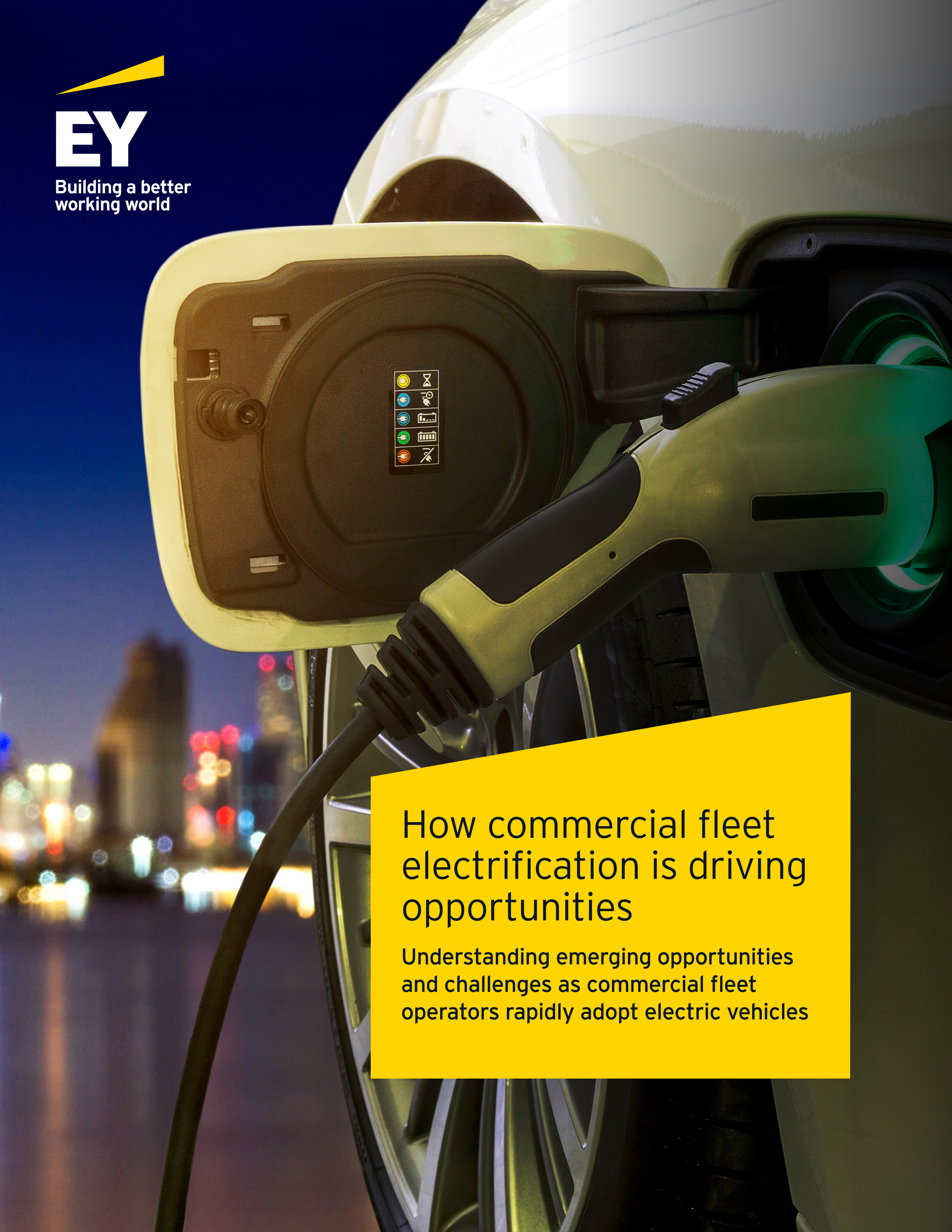


Building a better working world

How commercial fleet electrification is driving opportunities

Understanding emerging opportunities and challenges as commercial fleet operators rapidly adopt electric vehicles

Introduction

Electric vehicles (EVs) are one of the fastest-growing modes of transport in the US, including multiple vehicle types, such as cars, transit buses, trucks, delivery vans and electric bikes. The market is quickly moving toward maturity due to increasing demand, initiatives to expand charging infrastructure and the growing availability of diverse vehicle models. By 2050, the percentage of electric vehicles on the road is expected to reach 65% in the US, according to EY research — up from just 2% estimated for 2020. That's a jump from 2 million EVs to 88 million over 30 years, with EVs and internal-combustion engine (ICE) vehicles achieving cost parity in about 5 to 6 years in most regions.[1]

As part of this paper, we focus on a subsegment of the overall EV market: commercial fleet vehicles

Commercial fleet operators are now rapidly focusing on transitioning to a clean future through electrification of their vehicles, thanks to increasingly favorable economics. The percentage share of EVs within fleet sales quintupled from 2014 to 2018, and nearly 15 million EVs are expected to be part of corporate fleets in the US by 2040.[2] By 2025, EV costs are expected to plunge by about 30%, primarily driven by lower indirect costs (such as a reduction in R&D and administration expenses) and battery prices (through technological advances and expanded scale on the manufacturing side).[3]

Driving this transformation are a host of trends working in tandem: better technology, lower total cost of ownership (TCO) and improved charging network density, prodded forward by government incentives. Compliance with emission regulations, while somewhat in flux, is materially impacting the sales of alternative powertrain vehicles in the US, along with federal tax credits for plug-ins. Incentives at the state level, particularly in California, New York and Colorado, are also improving the overall TCO for consumers. The lack of commercial charging networks has restricted vehicle applications and operational flexibility, but private industry has been making investments to further develop EV infrastructure and create interoperable supply equipment systems. Utilities are also launching programs to support the emerging EV ecosystem.

This EV structural transition is opening a complex mix of opportunities for industry participants, including higher electric load for utilities, additional infrastructure requirements, and other behind-the-meter EV services. Some key emerging value pools in the EV ecosystem include:

- Vehicle/batteries financing
- New infrastructure (such as charging stations and transmission and distribution)
- Distributed energy sources (such as solar photovoltaic and storage)
- Analytics
- Energy management

These opportunities spotlight just how dynamic the EV environment is. For example, the trend of decoupling the ownership of the EV and the battery will begin to accelerate, generating more flexible leasing deals and blockchain platforms. Smart contracting can be deployed to manage the complicated ownership and transaction structures. As more fleet operators explore electrification, forward-thinking energy and infrastructure companies can position themselves to seize dramatic opportunities for growth by providing the underlying infrastructure and filling other needs across the value chain. In addition, this segment's electricity demands provide some upside to utilities' growth expectations against a backdrop of stagnant load growth.

With the market changing so quickly, what opportunities exist for corporates that want to explore fleet EV adoption — and how can other companies try to seize a first-mover advantage to respond to those needs?

Note: The EV penetration growth projections are pre COVID-19 estimates; these projections are subject to change in the coming months.

Table of contents

Figure 1. The fleet EV-related ecosystem is complex. Here's an illustrative list of emerging opportunities.

Fleet EV market outlook

The availability of EVs is steadily improving in the US, as automakers continue to bring more electric models to various vehicle segments across the market. A larger number of medium- and heavy-duty EV models are available, including delivery trucks, step vans, transit and shuttle buses, yard hostlers, and utility trucks. However, given the growing popularity of these vehicles and the current limited initial production, buyers may encounter wait times for purchases.

Transitioning fleets from traditional ICE vehicles to EVs currently makes more sense in urban areas rather than rural areas, given the shorter average trip length, access to public EV charging networks, and the additional benefit of reduced noise in residential areas. Currently, a wide chasm exists between fleet vehicle types. Light duty (LD) battery EVs make up approximately 99% of the fleet electric market, and adoption is geographically spread across the US. Adoption of other vehicle types, including medium duty (MD) and heavy duty (HD), is expected to continue improving as TCO falls over time. Separately, transit buses — the most popular vehicle type in the HD segment — are similarly driving electrification in the public sector, with electric school buses emerging recently as a promising growth area.

Government policies and incentives, the other key driver to growth, vary significantly across the US. Leading the way is California (home to most EV sales), along with nine other states that have adopted Zero-Emission Vehicle (ZEV) regulations and continue to implement a wide array of policies. The critical policy actions driving EV adoption in key regions include emission regulations (such as CAFE and SAFE), EV incentives (such as tax credits and loan programs), EV programs (such as the Electric Vehicles Initiative, which counts 16 countries, including the US, as participants), research programs and other infrastructure deployments.

Charging requires plugging into EV supply equipment (EVSE). Understandably, EV adoption is highly correlated with the presence of EV charging infrastructure, suggesting that this availability tends to precede EV growth. But caution is warranted in assuming that "If you build it, they will come." Infrastructure may simply indicate a favorable policy environment or could be the result of private investors, utilities and government institutions proactively responding to pre-existing EV demand.

A few forward-thinking utilities have also started to support the industry by providing multiple products and services, such as consultation programs, managed charging, leasing and infrastructure. These companies will continue to play a big role, beyond just serving additional electric load demand from these vehicles.

Emerging value pools in the EV market

The electrification of transport is still in its early stages, especially for commercial fleets, as is the corresponding rollout of EV charging infrastructure. Most EVSE companies and other service providers have been founded in just the past 10 to 15 years, with barriers to entry in this industry currently being mid to low. New entrants are emerging from multiple industries, with their business strategies tailored to growing customer needs.

Overall, the basic elements of the EV value chain are simple to understand. They include battery and vehicle manufacturing, retail, charging, and after-sales services. However, within this value chain, a wide number of players are trying to create a market share for themselves, such as utilities, oil and gas companies, technology providers, charging location owners, infrastructure operators, service providers, vehicle users, mobility providers, and financial services and leasing companies.

Many startups are also entering this space, focused on improving customer experiences and providing the required analytics. Tracking energy usage and developing payment systems that are easy for the consumer to understand and easy for the energy distributor to integrate within pre-existing billing systems are some of the key features required by customers.

Utilities have a significant role to play in improving the integration of EVs with the electric grid and providing the required infrastructure to help drive the growth of this market. Utilities will need to support the deployment of EV charging infrastructure, provide incentives to encourage investments by commercial operators, and upgrade the grid to handle additional electric load. Utilities could also support the evolution and deployment of software required to modulate charging rates or shift charging events to provide grid services. However, we note that developing the infrastructure and a smart grid is an ambitious goal, especially as market demand and return on investment (ROI) expectations are not well-understood.

Against this backdrop, we discuss the entry points for energy companies and others in more detail across four main categories.

EV batteries and vehicles

Today, selling EVs is a thin- or negative-margin business, due to high battery prices that account for a significant percentage of a vehicle's purchase price. Advances in technology and greater economies of scale are making batteries more affordable to deploy. In the meantime, corporates wanting to explore how to procure an EV fleet may find it more attractive to lease instead of purchase, while the economics grow more favorable in the near term. This trend is opening a secondary financing market.

Also, a few EV manufacturers and original equipment manufacturers (OEMs) are currently offering the option to purchase a vehicle and separately lease the battery — which typically needs to be replaced after 7 to 10 years — as a new business model. These leasing agreements are generally packaged with a warranty and battery replacement contracts, with the overarching goal of making the most expensive component in an EV today cheaper to afford up front. Additionally, third-party players have started to develop battery-as-a-service business models that are geared toward bringing more moderately priced battery replacement solutions to the public.

There are also opportunities in the market in repurposing and recycling EV batteries. After a typical EV battery is removed, around 50% to 70% of the power capacity is retained, which could be repurposed for tasks such as power backup, renewable-energy storage and grid stabilization. After a battery's second-life actions are complete, the final stage would ultimately be recycling. By 2025, about 75% of EV batteries will be reused and recycled to harvest new raw material, and commercial vehicles present the largest opportunity.[4]

In the US, various small players are operating in this fragmented market, acting as a middle party that collaborates with automakers, power utilities and recycling companies. While the market for recycling holds large potential, it is constrained by multiple factors. However, note that not all battery chemistries are equally suited to recycling, and there is a wide range of different chemistries and battery pack types currently in use.

Figure 2. Key applications of second-life batteries

Renewable energy storage	Grid stabilization	Backup	EV charging
Used EV batteries are ideal for storing electricity from renewables like solar panels and wind turbines and allowing its usage when needed.	Batteries can be used for handling the load shifting during high-peak demand.	Batteries can be used for backup supply power and improving power quality inside residential and commercial buildings.	Stored energy in used batteries can be leveraged to offer EV charging services in locations where constructing a high-power connection would be very costly.

Charging stations

Although there are many infrastructure operators in the US, a standard business model has yet to be established for EV charging stations. Overall, the EVSE vendor landscape is currently in flux, with numerous acquisitions, cross-industry investments and technological advancements in progress. Utilities, oil majors, network operators, software developers and more are becoming active in the market, to get the early-mover advantage.

Requirements for commercial and industrial charging infrastructure vary greatly, based on region and utility market structure, presenting an opportunity for utilities to help fleet operators evaluate and develop charging station strategies. Utilities are also in a strong position to finance charging infrastructure, given their access to relatively cheap capital, and with the right focus they compete with other incumbents and third parties for a share in the market.

Installation services will serve as the primary revenue driver in this market, more so than operations and maintenance. Many utilities offer special tariffs/plans for retailing electricity for EV charging, while operators of charging networks typically provide charging station hardware, cloud-based software services, technical support and other EVSE management services, such as payment processing. Utilities and EVSE operators will need to focus on smart-charging capabilities and their evolution, such as vehicle-to-grid charging.

By contrast, maintenance requirements for EV charging stations are low; based on Wood Mackenzie research, such work is estimated to be roughly 3% of the total EV charging infrastructure market. Most of the operators of charging networks are undertaking maintenance services in-house, so the opportunity for third parties is limited for now. However, the market for the maintenance contracts for charging infrastructure may increase over the years as the number of charging stations in operation will likely expand.

Distributed energy sources

Fleet operators could benefit from utilizing distributed energy resource (DER) technologies, including solar modules and inverters, fuel cells, energy storage, and more as a power source to charge their vehicles. While DERs make up a small portion of the overall US power supply, continued decline in the installation and operational costs will make these businesses cases more viable. The high costs of DER technologies are an obvious deterrent for fleet charging, but, compared against centralized charging, they offer greater scalability, reliability and flexibility.

These services are in a nascent stage, but a forward-thinking company can build capabilities to provide a one-stop experience for EV customers looking to use DG sets as a power source. Opportunities exist across engineering, procuring and constructing solutions for installation of distributed energy resources to support fleet electrification. As the market matures, competition from other energy services companies will increase.

Software and analytics

Fleet operators will increasingly look for software capabilities that will enable them to deploy and manage their own network of smart EV charging stations. Some of the key capabilities include real-time monitoring of charging stations, fault notification, electric pricing management, prioritized charging, customer reporting and mobile app access. Furthermore, additional benchmarking capabilities like vehicle utilization (on/off hours), driver behavior and cost metrics will create a more user-friendly experience for fleet operators.

Key considerations for fleet operators

Understanding benefits and challenges

Today's EVs are state-of-the-art vehicles that match or even surpass the performance of their conventional gasoline and diesel counterparts. Along with much quieter performance than conventional vehicles, these vehicles also produce maximum torque and smooth acceleration from a full stop. However, some MD and HD vehicles have a limited maximum speed and driving range constraints. Below, we have highlighted some additional benefits and considerations of owning an electric fleet.

Figure 3. Multiple benefits exist for fleet operators to prioritize electrification.

Financial	Operational	Environmental
▸ Resilience to fuel price fluctuations ▸ Favorable government subsidies and rebates ▸ Potentially lower tariffs by utility companies during non-peak-hour charging ▸ Improved TCO	▸ Reduced operational and maintenance costs ▸ Less crew fatigue due to no gear changes and clutch movements ▸ Extension in work hours of crews performing non-emergency work in communities with noise restrictions ▸ Improvement in overall operational safety	▸ Compliance with environmental regulations and internal greenhouse gas targets ▸ Promotion of fuel diversity (since the US mix of fuels used for power generation varies considerably) ▸ Positive PR opportunity by adopting environment-friendly solutions

Figure 4. However, multiple challenges also exist for developing a successful electric fleet.

Financial	Operational	Infrastructure
▸ Higher initial purchase price versus traditional ICEs ▸ Continual need to have a detailed understanding of changes in government tax incentives, rebates and more ▸ Need to optimize charging, to match favorable electricity cost timing	▸ Constraints on driving range ▸ Additional planning requirements for charging ▸ Compatibility of charging infrastructure ▸ Impact of extreme weather/ temperatures ▸ Operator acceptance and new skill set development ▸ Rapid changes in technology (hardware/software)	▸ Limited and uneven number of charging stations across states ▸ Constraint on vehicle/spares availability in the market ▸ Limited operations and maintenance services ▸ Potential upgrade of utility circuit infrastructure to handle new load

Modeling total cost of ownership

Typically, EVs have lower operation and maintenance costs, better fuel economy and lower taxes compared to ICE vehicles but significantly higher purchase prices. At present, industry consensus is that EVs are becoming cheaper as production volumes increase and battery costs continue to decrease toward $100/kWh, the price thought to be a critical inflection point for the mass adoption of EVs. While many considered this to be four to five years away as recently as 2018, some automakers now believe that this target has already been reached.

To make the overall cost comparison between the two vehicle types over their ownership period, TCO modeling is used. It clarifies the true cost of owning an EV, including direct and indirect costs, and helps buyers understand when EV costs equal that of conventional vehicles, known as TCO parity. Our proprietary TCO model helps lay out all the different cost drivers in the calculations and analyzes the sensitivity of different variables, including capital costs, regulatory incentives, fuel/ electricity rates, salvage value, operational and maintenance costs, and growth rates.

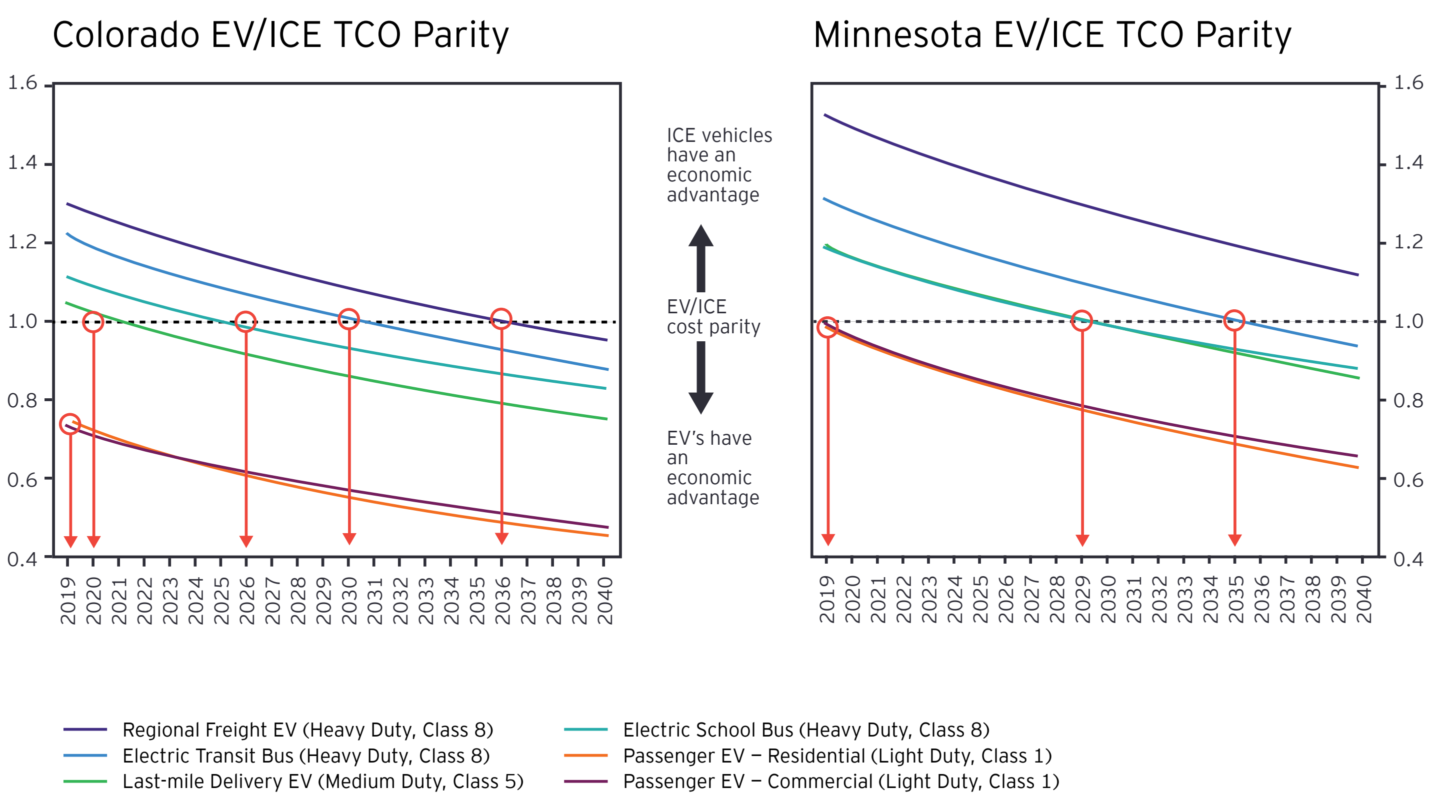
Figure 5. Description of some of the key costs in the TCO modeling

Cost category	Description	Key considerations
Capital cost	‣ Estimating the average vehicle cost for some heavy-duty vehicles could be challenging because publicly available data is limited. However, as these vehicles become more available, so will the data. ‣ Besides the vehicle cost, other capital costs include the infrastructure required to maintain the operations, such as dedicated charging stations and additional distribution generation technologies like solar PV and energy storage, depending on the requirements of fleet operators. ‣ In addition to the charging stations, fleet management software is key as well, providing telemetrics, advanced booking and scheduling, real-time tracking of vehicles, keyless entry and more.	Battery technology is improving drastically every year, resulting in increased charge capacity and lower operating cost per mile. Capital costs are somewhat offset by state and local incentives that encourage alternative fleet implementation through funding and technical assistance.
Depreciation	‣ Depreciation is one of the biggest costs in the vehicle TCO analysis and hence of great importance for new-car buyers. ‣ Depreciation varies widely by vehicle make and model. For instance, studies have shown that certain models retain 40% of their value after five years whereas others retain about 15% of their MSRP over the same time period.[5]	Electric vehicles tend to have higher rates of depreciation for the following reasons: ‣ Second owners cannot take advantage of tax incentives ‣ There is a need for battery replacement (real or perceived) ‣ Rapid innovation in vehicle and battery technology depresses demand for older EVs
Fuel and electric cost	‣ EVs typically achieve better fuel economy and have lower fuel costs than similar ICE vehicles. ‣ In addition to the fuel efficiency with EVs, the cost per kWh of electricity tends to be lower and more stable than the cost per gallon of gasoline and other fuels.	A key consideration for EVs is the daily charging schedule. Managed charging and off-peak vehicle charging reduces electricity requirements during peak energy demand periods, potentially adding thousands of dollars in savings.
Operation and maintenance (O&M)	‣ Given many moving components, ICE vehicle repairs on the engine, transmission system and gearbox are highly likely over the vehicle's lifespan. ‣ EVs have fewer moving parts that need no oil or filter changes and less brake pad tear due to its strong regenerative braking.	The O&M costs for EVs are estimated to be roughly 50% less than their petroleum counterparts (although those costs are still relatively unknown for EVs because they haven't been on the market for very long, comparatively).

Some of our key observations after modeling the TCO for EVs:

- Vehicle capital cost is the most sensitive variable determining the timing of when EVs reach TCO parity with ICE vehicles. However, the capital cost spread between EVs and ICE vehicles is narrowing over time as battery costs fall.
- EV economics are improved due to their considerably lower maintenance costs compared with ICE vehicles. Maintenance cost savings typically range from 30% to 70% (about 40% cost savings averaged across multiple studies).[6]
- Electric rates have a weaker impact on TCO parity timing than capital costs, although still significant.
- Managed charging, in conjunction with time-of-use rates, can expedite the economic attractiveness of fleet EVs. In MD and HD vehicle segments, managed charging can expedite the economic attractiveness of EVs up to a decade in utility service territories with high demand charges.
- Fleet management software is highly recommended to provide other services for customers, including telemetrics, real-time tracking of vehicles and more.
- Regulatory policies, rebates and incentives are particularly favorable on the West Coast and in the Northeast, for EV owners of all types. For instance, in New York, the Drive Clean Rebate offers up to $2,000 for the purchase or lease of an EV with a battery capacity of at least 4 kilowatt hours. Sales tax exemptions and access to high-occupancy-vehicle lanes also exist. In addition, state and federal regulators are using policies and incentives to encourage utilities to take a proactive approach to the electrification process.

Figure 6. Comparison showing how EVs will reach TCO parity with ICE vehicles at different points in time based on location, category and use case



Sources: EY analysis.
Note: The TCO model uses actual EV (and ICE equivalent) purchase prices submitted by OEMs as part of the New York State Truck Voucher Incentive Program. Fleet EVs assume a 10% volume discount on the purchase price. EV charging costs are based on current rate schedules. These are: Colorado: Residential – Residential Energy Time of Use (Schedule RE-TOU), Commercial – Secondary Time of Use Service (Schedule STOU); Minnesota: Residential – Residential TOD Underground Standard (A04), Commercial – General Service Time-of-Day Metered (A15) Primary Voltage. Assumes managed charging is not utilized with charging starting at 6:00 p.m. across all vehicle classes and applications.

Business case consideration for fleet operators

For fleet operators interested in investing in EVs, developing an insightful business case requires thoroughly understanding the TCO, local regulatory environment and how many stakeholders collaborate, including local utilities, infrastructure providers and financing parties. The key due diligence activities and considerations include:

- Overall objectives for the investment, such as savings and sustainability
- Overall expected returns from the investment
- Understanding of local regulatory policies/support
- Site identification with characteristics driving economic feasibility, such as transmission access
- Selection of ideal partners, like infrastructure providers and O&M contractors

Figure 7. A detailed business case should include a wide set of considerations, focusing on internal strategy, partnership and operation

Key Inputs

- Total cost of ownership
- Local regulatory policies
- Operational preparedness
- Infrastructure availability
- ROI requirements

Fleet electrification planning

Key considerations to include in the strategy

Strategy considerations

- Long-term strategy and an implementation framework for electrification
  - Planning to include: establishing financing, charging infrastructure/rates, local integration of storage and renewables, etc.
- Primary motivators for the fleet electrification
- Leadership buy-in to develop the overall electrification strategy
- Clarity focus: gradual fleet electrification vs. an accelerated change
- Prioritized list of fleet locations to move towards electrification; top location to pilot

Utility considerations

- Rate structure, managed charging options
- Nearest substation, and its ability to support the new electric load
- Load sharing options, infrastructure funding (self-funding vs. utility program)
- Strategy for additional DERs, including local storage or generation
- Local utility's bulk-power capability to support full-fleet electrification
- Regulatory environment supporting preparations for electrification

Operational considerations

- Charging infrastructure requirements (Level 2 or DC fast-charging, quantity)
- Educate operators to provide new skills and knowledge to work on electric propulsion systems
- Plan to hire operational specialists to maintain their chargers and infrastructure
- Safety and accessibility considerations
- Meeting local zoning and building code requirements

Detailed fleet electrification business case

Summary

EV adoption is growing rapidly from a small base, thanks to improved battery technology, more EV models with a longer battery range and lower overall TCO. Price parity is due in the next few years, so new players will be entering the market — meaning that now is the time to make a move to unlock EV value pools to capture maximum value.

For utilities, there remains an opportunity to shape policy, develop new revenue streams, provide the necessary infrastructure to customers, and energize the entire EV ecosystem. But for fleet operators, understanding all the costs for running an electric fleet is key. Besides costs, other considerations to focus on include the features and benefits/pros and cons of various EV models and equipment, supply chain challenges of fleet electrification, vehicle range issues, regional variables, and more.

Through the proprietary EY TCO model, organizations gain data-driven insights into the true cost of owning an EV and when TCO parity can be achieved, emboldening their decision-making process and helping create a road map toward succeeding in the market of the future. The model takes the complex intertwining of variables — such as capital costs, regulatory incentives, and operational and maintenance costs — and introduces more clarity for actionable plans.

Notes and sources

[1] "As the countdown to a new energy world intensifies, who will beat the clock?," EY, ey.com/en_gl/power-utilities/as-the-countdown-to-a-new-energy-world-intensifies-who-will-beat-the-clock, 3 July 2019.

[2] BMI Research; U.S. Department of Transportation; BNEF; EY analysis.

[3] "Update on electric vehicle costs in the United States through 2030," ICCT research paper.

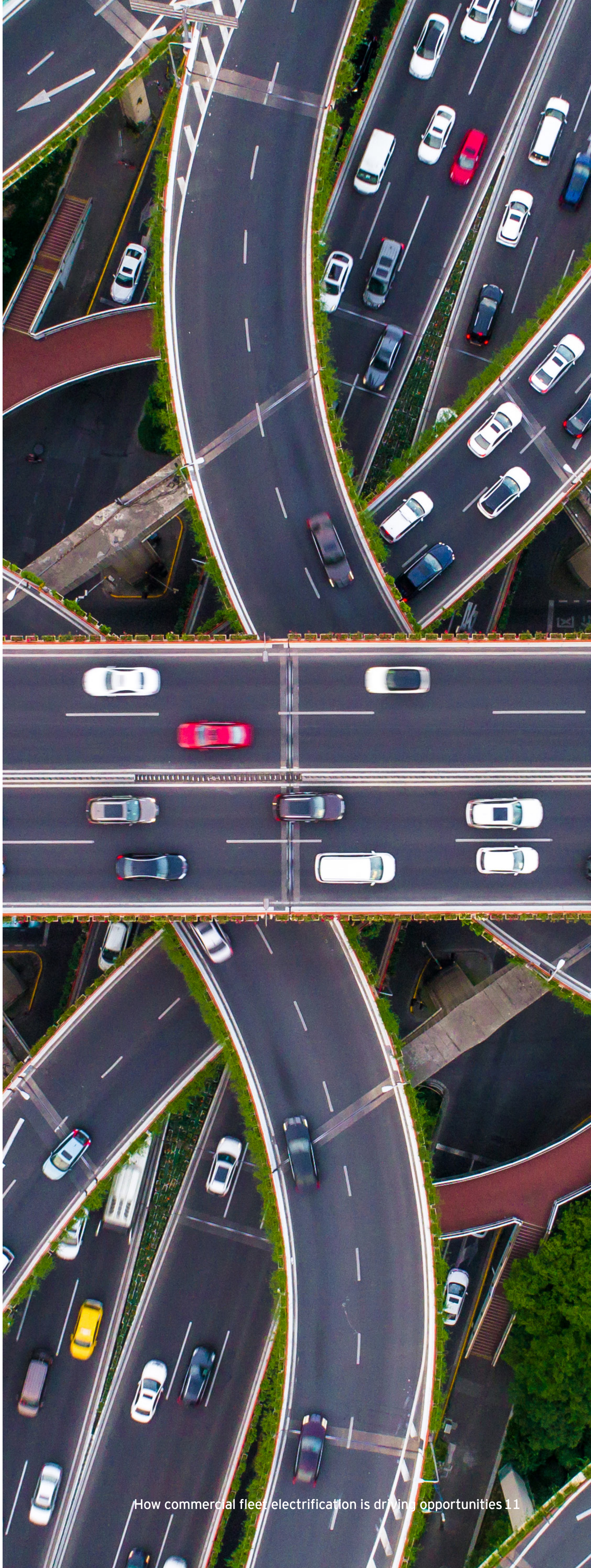
[4] "The Afterlife of Electric Vehicles: Battery Recycling and Repurposing," Institute for Energy Research, instituteforenergyresearch.org/renewable/the-afterlife-of-electric-vehicles-battery-recycling-and-repurposing, 6 May 2019.

[5] Breetz, Hanna L., and Deborah Salon. "Do electric vehicles need subsidies? Ownership costs for conventional, hybrid, and electric vehicles in 14 US cities." Energy Policy 120 (2018): 238-249.

[6] "Tanco, Martín, Luis Cat, and Santiago Garat. "A break-even analysis for battery electric trucks in Latin America." Journal of Cleaner Production 228 (2019): 1354-1367"

Other sources

1. US Department of Energy (DOE)
2. US Energy Information Administration (EIA)
3. National Renewable Energy Laboratory (NREL)
4. Solar Electric Power Association (SEPA)
5. Company disclosures
6. SNL Energy/S&P Global
7. EY analysis

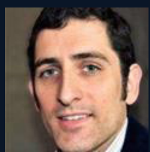


EY authors and contacts

US contacts

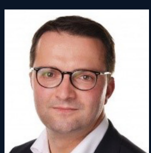
Simon Watson
North America
e-mobility Lead
+1 703 747 0760
simon.watson@ey.com
McLean, USA

Jaideep Malik
Americas Advisory –
Power & Utilities Strategy
+1 404 940 7679
jaideep.malik1@ey.com
Atlanta, USA



Patrick Brown
Americas Advisory –
Power & Utilities Strategy
+1 704 331 2061
patrick.brown1@ey.com
Charlotte, USA

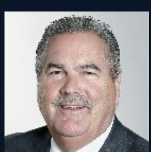
Global contacts



Thierry Mortier
Global Energy
Innovation Leader
+32 477 59 72 72
thierry.mortier@be.ey.com
Brussels, Belgium

Marc Coltelli
Global E-mobility Co-Lead
+44 07972 124 640
mcoltelli@uk.ey.com
London, UK

Duke Energy author



Douglas F Esamann
Executive Vice President
Energy Solutions and President,
Midwest/Florida Regions and Natural Gas Business

As executive vice president, energy solutions, Doug Esamann is responsible for corporate and regulatory strategy, emerging technology, and the company's regulated and commercial renewable energy operations. Additionally, he is responsible for sales and services to commercial, industrial and wholesale customers; the development and marketing of products and solutions for all customer segments; and the company's economic development efforts.

EYG no. 001193-20Gbl

1911-3318476
ED None

ey.com