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FAST TRANSIT: WHY URBAN E-BUSES LEAD ELECTRIC-VEHICLE GROWTH

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Looking for the most successful electric-vehicle segment? Take the e-bus.

Urban electric buses (e-buses) don't break many speed records, but they are surpassing the growth of every other electric-vehicle (EV) segment: they constitute the fastest-growing part of the EV market, with a compound annual growth rate of more than 100 percent since 2013, compared with 60 percent for fully electric passenger cars. Urban bus fleets in Europe should largely transition to electric power by 2030, also supported by the proposed e-bus target of 75 percent of all buses sold in Europe by that year. One reason for the e-bus penetration advantage is a European Commission report that proposes this target. The report says that markets for low- and zero-emission urban buses are further along the road to "maturity, whereas markets for low- and zero-emission trucks are at an earlier stage of market development."[1]

A strong pull from customers, including public-transit operators and city governments, is another impetus to the strong performance of e-buses. Regulatory and political influences, public demand, and government subsidies are making these customers quite willing to pay for clean technology. They view e-buses as attractive even though the vehicles won't provide a total-cost-of-ownership advantage until 2025 to 2030, because of the high up-front investments in the buses themselves and in infrastructure, as well as the probable need for battery swaps over the life cycle of vehicles.

E-bus momentum emerges worldwide

China, the world's largest bus maker, has also taken the lead in e-buses. First of all, it has the largest market: e-buses already accounted for 90 percent of new urban bus sales in 2017. Of the 97,000 urban buses sold in China last year, fully 87,000 units had electric powertrains—at a time when the entire European urban bus market (electric and conventional) amounted only to some 13,000 units. Shenzhen alone, a major city in Guangdong Province, purchased more than 16,000 e-buses over the past five years. In fact, more than two-thirds of all e-buses in the world travel on roads in China.

1 Proposal for a directive of the European Parliament and of the Council amending directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles," document 52017PC0653, eur-lex.europa.eu.

North America, by contrast, is a minor segment of the global e-bus market: fewer than 500 e-buses were sold there in 2017. Except in a few metropolitan areas, the number of e-buses in North America will probably increase slowly, according to analysts. In contrast, manufacturers in Asia have supported this market. Asian production facilities can exploit synergies from e-truck production.

In Europe, we expect the number of electric city buses to rise by about 18 percent a year. In 2030, they will account for approximately three-quarters of annual urban bus sales. One proof point for this estimate is healthy near-term demand; urban showcases already exist in London, the Netherlands, and elsewhere. Our research suggests that the demand patterns for e-buses largely reflect the overall trend among cities to embrace electrification and new mobility business models and technologies, such as shared mobility and autonomous vehicles.

Customer demand—primarily a combination of political, regulatory, and cultural pressures—largely drives European city e-bus markets. Economic considerations play a lesser role, since the total cost of ownership remains significantly higher for e-buses than for diesel ones. In Europe's largely stagnant bus market, large cities and "green countries" (mainly in Western Europe) will probably continue to adopt electric buses first: the former because curbing air and noise pollution is an urgent issue, the latter to fulfill their commitments to safeguard citizens from environmental dangers. Our model of regional urban e-bus uptake indicates that these areas will adopt electric buses more quickly and at higher rates.

The e-bus phenomenon presents cities with three major challenges: high technological uncertainty, large up-front investments, and the need for new capabilities. We therefore expect a majority of e-bus sales in Europe to be packages as part of larger transit investments—for instance, e-buses plus infrastructure plus additional services. By taking this kind of holistic approach, cities can effectively outsource many e-bus uncertainties, especially in small and medium-size cities. Larger cities will typically be able to leverage their own infrastructure capabilities and might buy components separately—especially after the initial learning phase has passed.

E-buses represent a first step toward future mobility goals

As cities seek to realize their future mobility goals, the first step, for many, involves moving toward smart, clean, integrated solutions made possible by e-buses. However, to get there, cities need new infrastructure—and they need it now. That means a combination of hardware (charging stations, which often require a full redesign of bus depots, and other required equipment), as well as software solutions that can collect and use driving-profile and vehicle-health data. This kind of solution will go far beyond today's IT systems, given the greater complexity of e-bus operations, from battery life-cycle monitoring to range calculations and charging management.

Many companies can already help with these challenges. Some e-bus manufacturers, for example, can assume full responsibility for a system, partnering with charging-infrastructure providers and other companies to deliver an end-to-end e-bus solution. Other companies offer comprehensive packages and take full responsibility for the complete system's service

and maintenance. Several transit operators have core multidisciplinary teams to manage and execute bids or deliver projects. These teams validate all components of a tender, including contractual clauses; the integration of innovations, operating costs, and investments; and quality and safety considerations.

In many cases, urban planners begin their encounter with e-buses incrementally, buying a handful of them to test the waters and later, with growing confidence, expanding their use as the benefits—cleaner air and quieter streets—become apparent.

Consequently, e-bus makers often focus initially on selling a few vehicles to cities. Later they take a broader approach, bundling e-buses with tailored charging, maintenance, and traffic-management solutions (including value-added opportunities)—especially for smaller cities that lack the expertise required (in high-voltage lines, for example) or the risk appetite to go it alone. E-bus OEMs may have opportunities to become preferred vendors, with a single point of contact, and ultimately to become key partners.

Approached systematically, the transition to e-buses can open a clear pathway to a city's future mobility goals and vision. For starters, it is an important first step toward a long-term vision of sustainable mobility and emission-free cities. In addition, the transition to the next technological horizon—autonomous transport, which will most likely have a major impact on urban mobility—would no longer appear so far away. With this in mind, we believe that it will be crucial to design these e-bus systems so that they can easily be adapted to manage autonomous buses in the future. That would make possible an even deeper integration of various mobility modes into intermodal transport, including autonomous taxis and shuttles.

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E-buses not only represent an exciting advance in the electrification of vehicles but also point the way for other electric-vehicle segments. As cities pursue their future mobility goals, the e-bus experience can help them pilot the transition to a clean, green tomorrow with a minimum of risk and turmoil.

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