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Engineered Fastening

Electrification Beyond Cars:
Exploring EV Opportunities for Bus, Trucks, Vans & Utility Fleet

The global market for medium-duty vehicles (MDVs) to heavy-duty vehicles (HDVs) is rapidly evolving, with growing demand for electrification driving the change.

The move to electrification has some analysts predicting a nearly $50 billion global industry within the next decade. A glance at every major manufacturer of vans, trucks and buses confirms the trend: each has at least one all-electric vehicle model in development. Several years ago, this was unthinkable, but shifts in technology and policy have resulted in growing global demand for commercial electric fleet vehicles, leading manufacturers to expand their product lines.

A confluence of factors are driving EV fleet growth: increasing fuel prices, dropping EV battery costs, an expansion of charging infrastructure, and the introduction of new regulations and incentives by governments and cities aiming to curb carbon emissions or improve air quality. Additionally, pandemic lockdowns spurred massive growth in ecommerce, online purchases, and deliveries, and as a result brought new investment to the manufacture of electric delivery vans and trucks. According to McKinsey & Company research, the shift to EVs in commercial fleets has the potential to grow from 5,000 units in 2018 to 8 million by 2030.

There are a number of challenges, but also opportunities that arise around the electrification of commercial vehicles, for both physical performance and manufacturing. While charging capacity and infrastructure is an operator concern, manufacturers face technical challenges. The race to innovate can create quality control issues, and from battery assembly and mounting to production and weight optimization. Behind every manufacturer fighting to meet demand for electrified fleet vehicles, component suppliers like STANLEY Engineered Fastening are working on the technologies that empower customers to accelerate towards an electric future.

POTENTIAL GROWTH PROJECTION TO SHIFT TO EVS

Exploring Global Market Trends for Electrification in Bus/Truck/Van/Fleet and Utility Vehicles

The global markets for electrification of fleet vehicles are concentrated in Asia, Europe, and North America. With climate initiatives driving demand, fleet electrification is an inevitability: shifting the heaviest, most fuel-consuming vehicles to electric will achieve emissions targets much more efficiently than electrifying small cars. But as innovations in design, manufacturing, and technology make electric vans more affordable, durable, and reliable, the advantages to fleet owners will also further increase market demand.

Global Market Growth Estimates

Light Commercial Vehicle (LCV) Projections

According to the International Energy Agency (IEA), the current global stock of electric light-commercial vehicles (eLCVs) is only around 435,000 units, but that is changing quickly. In January 2019, Analysts at Frost & Sullivan predicted EV penetration of the global LCV market would be 15.9%, while forecasting a 28.2% CAGR between 2017 and 2025.

Despite shifts in the global economy due to COVID-19, their general forecast has prevailed: current trend analysis indicates China and Europe leading e-LCV adoption up to 2025, with 68.2% of global eLCV sales, after which the balance shifts to North America, where the market is expected to grow to one-in-three of all global e-LCVs sales by 2030.

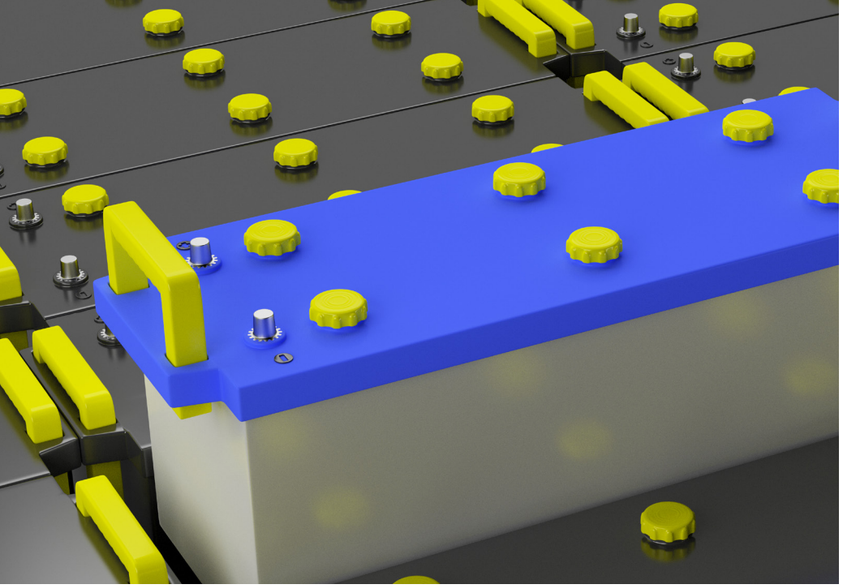
China's current dominance in the eLCV market can be attributed to their aggressive incentive structures for fully electric electric vehicles, superior technology readiness, and the large-scale, nationwide installation of charging stations. The European market accounts for one third of global eLCV, with registrations jumping almost 40% from 2019 to 2020.

Electric Bus Market Projections

In 2020, electric bus registrations increased in China, Europe, and North America. In China, where air quality improvement policies are driving electrification, electric bus models accounted for 27% of all bus sales, up 9% from 2019. Over the same period of time, sales in Europe increased 7%, with electric buses now accounting for 4% of all new European bus registrations. This is partly due to the non-binding European Clean Bus Deployment Initiative, a voluntary pledge amongst EU cities and regions to commit to low-emission buses. In North America, electric bus registrations fell almost 15% in 2020, due mostly to economic uncertainty, but are set to rise as public health and environmental concerns will favor the use of e-buses. In June 2021, the U.S. Department of Transportation allocated $182 million to 49 e-bus projects in 46 states. Some analysts forecast a CAGR of about 26.76% in the North American e-bus market between 2018 and 2027.

Heavy Duty Truck Projections

The global heavy-duty truck (HDT) market reported a 10% increase in global registrations in 2020, with China accounting for 90%—the vast majority. Nonetheless, growth in the sector is anticipated, as battery costs fall the potential savings are more broadly recognized. Growth in the European electric truck market is expected to increase by 18% from 2020-2025. Electrified medium and long-haul trucks offer a total cost of ownership that is 13% lower than diesel trucks, with innovations potentially bringing savings to 50% by 2030. Electrified class 8 long-haul trucks may save operators up to $200,000 over a 15-year lifetime. These factors all contribute to forecasts predicting that the market for electric Class 7 trucks in the United States will grow at a CAGR of 73% through 2026. Market momentum will likely continue as more manufacturers unveil new electric models.



Market & Manufacturing Trends

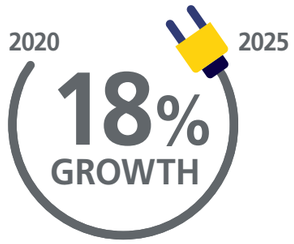
The EV market has been transformed in a mere two years, with EV fleet expansion rapidly moving through the world's largest vehicle markets. Today, almost a dozen of the world's largest OEMs have set electrictrification targets for 2030. Where recently only a small handful of models were available, the growing range of zero-emissions commercial vehicles make clear the commitment manufacturers have made to meeting operational needs and government regulations.

Market Trends

Electric buses, the current fleet market leader with the most firmly established zero-emission track record, will boast 262 models available (up from 247 in 2020), by the end of 2022. This 6% rise is primarily due to an increase of models in the Chinese market. Buses may have been the first to successfully model electrification in the HDV market, but as demand for electric trucks increases, manufacturers are feeling the pressure to expand their lines. The heavy-duty vehicle (HDV) market segment encompasses everything from garbage collection units to long-haul freight trucks. Due to the combination of stringent new emissions policies and incentives targeting commercial vehicles and the clear reduction in fuel and maintenance costs they offer, from 2020 to 2025, analysts expect the European market for electric trucks to grow at a rate of 18%. The Europe market currently offers the largest selection of heavy freight trucks (HFTs), while the United States has the broadest range of electric medium freight truck (MFT) models. The HFT segment is expected to see the most growth in coming years.

Of note, one of the strongest drivers of electrification is private sector demand for zero-emission commercial vehicles. Interest from logistics providers across the globe is strong. Amazon's goal of achieving net-zero emissions by 2040 led the company to order 100,000 light commercial vehicles from up-and-coming manufacturer Rivian. UPS announced in 2019 that they were ordering 10,000 BEV light-commercial vehicles with potential for a second order. Within six months of its debut, Anheuser-Busch, FedEx, Walmart, Pepsi, Sysco and other large multinational corporations pre-ordered 2,000 Tesla Semi models.

MARKET EXPECTATIONS FOR ELECTRIC TRUCKS SALES IN EUROPE



These alone represent a dramatic increase in the commercial EV market, and they are only the tip of the iceberg.

Manufacturer Trends

The shift to commercial fleet electrification began gaining momentum in 2019, when Daimler, Fiat, Ford, Renault-Nissan, and Volkswagen all released new eLCV model. In recent years, BYD, Daimler, Nikola, Peterbilt, and Volvo—rolled out new electric Class 8 (heavy-duty) models. Truck industry titans Daimler, MAN, Renault, and Scania appear to be leaning towards a future market that is entirely electric.

Plans to produce exclusively electric product lines are underway in various OEMS. In 2021 alone, Ford announced that from 2030 it will only sell electric cars in Europe, by 2035, General Motors will only offer electric LDVs, and Volvo will sell electric cars only from 2030. Volkswagen has set the goal for 70% of their Europe models to be electric, 50% in China 50% and 50% in the United States by 2030; and Stellantis (owner of Peugeot, Chrysler, Opel, Citroën, Dodge, Maserati, and more) is aiming for 70% electric cars sales in Europe and 35% in the United States.

But the zero-emission HDV market is not limited to major players and legacy OEMs. Early market leaders have included industry newcomers like BYD, GreenPower, Lion Electric, and Proterra. These young, nimble startups are bringing fresh energy and zero-emission commercial truck and bus models to eager customers. Over the past five years, the influx of new manufacturers has increased pressure on traditional OEMs to increase the number of electric models across product lines, or risk losing market traction. Meanwhile, OEMs that failed to adapt early on are forging partnerships with startups and well-positioned manufacturers and suppliers in the electrification market.

The recognition that the future is in zero-emission vehicles is apparent in the emergence of collaborative partnerships across the industry. Even direct competitors are acquiring or forming strategic relationships with smaller suppliers in the zero-emission market. Some powertrain companies and zero-emission manufacturers have made product development alliances with suppliers of components and legacy OEMs.

Set for production in 2022, Ford's E-Transit electric delivery van will be the first electric LCV in the American market manufactured by a legacy OEM. Other American OEMs are expected to follow suit, spurred by the California Air Resources Board Advanced Clean Trucks (ACT) regulation. The regulation requires manufacturers of medium and heavy-duty commercial vehicles to report zero-emissions vehicles as an increasing percentage of their annual sales from 2024 to 2035. Domestic competition will likely come from GM, with the development of the BV1, and all-electric delivery van. In Europe, the Ford Transit has been a market leader, but the electric model came late—after the Mercedes eSprinter, Opel Vivaro, and VW Crafter.

Challenges/Solutions

The need for public charging infrastructure is one of the major obstacles in an industry that has up until now primarily focused on serving consumer electric vehicles. The electrification of medium to heavy-duty commercial vehicles presents more significant, long-term challenges. Heavy freight trucks require high capacity batteries to meet the heavy-duty cycles of long-range operations, and those batteries require high-power charging. It will be necessary to install a national network of megachargers (1 megawatt capacity) to ensure that freight trucks operating over long distances can charge relatively quickly.

To avoid negatively impacting the existing electrical grid, significant advance planning is necessary. Grid modernization, reinforcement, and power system storage and integration will require coordination between distribution system operators, power suppliers, and mega charging operations. But the race for solutions is well underway. The CHAdeMO association, working in tandem with the China Electricity Council, has developed an ultra-high (up to 900 kW) power charging standard, named ChaoJi. A 1.8 MW version, called Ultra ChaoJi, is currently being developed. Simultaneously, CharIN, a global association, established the Megawatt Charging System Taskforce to develop a new high power standard for heavy-duty truck charging, based on the combined charging system (CCS) standard. Prototype testing began in September 2020, with the goal of achieving success by 2023. Tesla is one of five to have submitted a design to CharIN.

Various international efforts are underway to develop a charging standard for commercial vehicles while also establishing robust mega charging infrastructure.

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New Technology, Old Challenges: vibration, production efficiency and safety - meeting the market demands for new applications

Bus, truck, and utility fleet manufacturers have always had to solve the issue of vibration. Now, electrification presents automakers with a wide array of new challenges, from battery assembly and integration to streamlining manufacturing processes. Lightweight construction is critical for EV efficiency, and every bit of weight reduction improves battery performance. This focus on lightweighting has resulted in the use of innovative multi-material vehicle constructions, many requiring new fastening solutions. For example, the larger, heavier batteries needed to power EVs are often integrated to the chassis, requiring joining solutions capable of connecting different material types reliably and consistently.

Battling Vibration in Commercial Applications

Buses, delivery vans, and medium to heavy-duty trucks carry heavier loads over greater distances than passenger vehicles, and are thus subjected to far more stress and vibration. Conventional nuts and bolts provide minimal vibration resistance, which can lead to more maintenance and downtime as components loosen. But in EVs, a loose fastener can cause a short circuit or system failure. Designed for use in heavy-duty applications, NeoBolt® lockbolt technology solves the vibration issue for structural fastening in commercial EV. Ideal for connecting subsystems to the chassis assembly and for battery bracketing, these lock bolts eliminate the need for torquing tools and are designed for fastening elements that don't need to be removed or serviced.

–Spiralock/WedgeLock solutions–
Al Schindelar asked to highlight Wedgelock for anti-vibration Spectralock® Fastening Solutions
Seven bolt variants recommended for better thread engagement and vibration resistance for: Cradle assembly, Battery mounting structure, Drive motor mechanism.

Designed for use in heavy-duty applications, NeoBolt® lockbolt technology solves the vibration issue for structural fastening in commercial EV.

VIBRATION ISSUES SOLVED

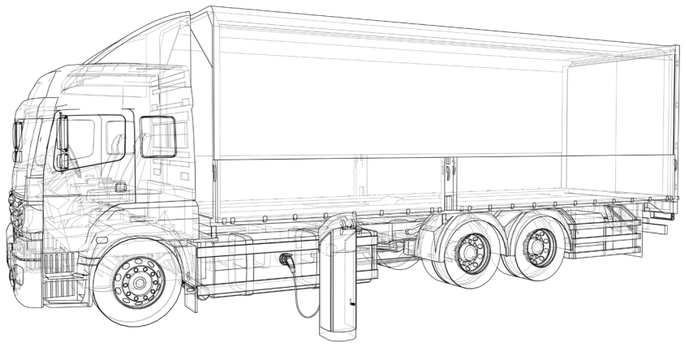
NeoBolt® lockbolt technology solves the vibration issue for structural fastening in commercial EVs.

Increasing Production Speed To Increase Efficiency

As OEMs transition into EV manufacturing, they must make dramatic adjustments to their assembly processes. The lack of exhaust systems, alternators, fuel injectors, or starters that are critical in combustion engines means moving to more simplified production. However, because OEMs are competing with manufacturers who began in EV and have streamlined their production, efficiency is paramount. Using lockbolts and speed fastening systems like Neospeed® or Rivscrew® can facilitate the development of fully-automated assembly processes. Speed fastening systems can be used to assemble metal and plastics, composite materials and electronic components in less than two seconds, from one side.

Streamlining Operational Manufacturing Processes

When it comes to operational efficiency, the gains of several seconds per fastening add up. Only last year, Volkswagen reported that it takes around 30 hours to produce an ID.3 EVs, compared to Tesla, whose Model 3 can be completed in only 10 hours. The seconds, minutes, and eventually hours gained in production time through more efficient processes enables greater competitiveness in an increasingly crowded field. Speed fastening systems for interior vehicle components help optimize production time. Lockbolts eliminate the cost of expensive torquing tools and the labor associated with placing nuts and bolts. Finally, replacement of pneumatic tools with hydraulic tools and handheld battery-operated tools drives operational efficiency through faster, safer, and more cost-efficient processes.



Safety Is a Must - Overcoming Safety Challenges in Electric Commercial Vehicles

Manufacturing

With their high voltage batteries and charging systems EVs present manufacturers with a unique new consideration: protecting drivers and occupants from all potential electrical hazards by using robust, reliable grounding.

Superior Grounding Technology

Grounding is of particular importance with EVs, because unlike internal combustion engine (ICE) vehicles where only a few standalone elements are electrically powered, the battery essentially is the engine. An EV grounding issue can cause operational failure. Electric current only flows when it has a path to take back to its source. In ICE vehicles, current moves from the positive battery terminal to the electric element, then back to the negative terminal through the vehicle's metal structures. EVs are too well insulated for this type of loop to occur.

To overcome this challenge, Stanley Engineered Fastening uses Tucker® No-Hole Ground Studs, a grounding system that outperforms all available solutions by allowing the highest current levels and the most consistent resistance level of less than 100 µΩ over the lifetime of vehicle, with the lowest dispersion of resistance values. The Tucker stud welding process controls quality by using advanced monitoring capabilities and instant feedback.

BATTERY SAFETY

SEF has developed engineered plastic components that have excellent strength to weight ratio for use in Battery modules.

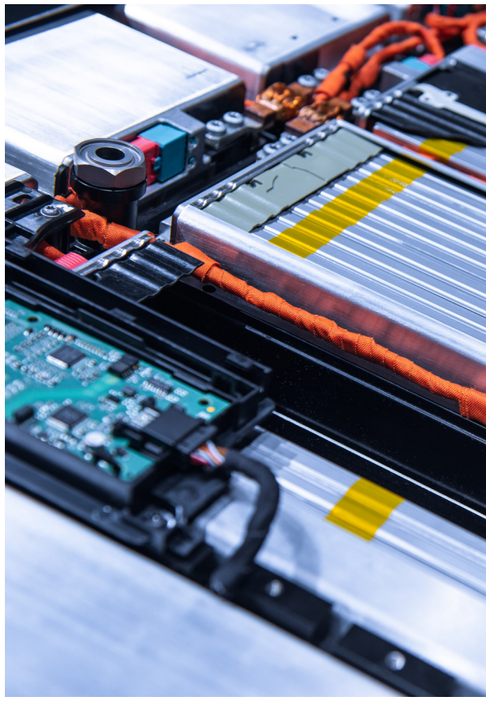
Battery Safety Solutions

Over their lifetimes, EV batteries are heavily stressed by fast charging and extreme temperatures. Battery charging capacity is also affected by temperature. Battery management systems traditionally do not adjust the degree and rate of charge based on temperature gradients, leaving batteries vulnerable to heat-related damage or even internal shorts that can lead to ignition. To solve this issue, SEF has developed various EV battery safety solutions.

SEF has developed engineered plastic components that have excellent strength to weight ratio for use in Battery modules—which both reduce overall weight and make for easy locking and assembly. Our advanced sealing and thermal management include using rivet solutions to seal electrolyte fill holes (in Li-ion cells) and adapting a cooling hose routing system. And specialized cable and plastic protectors protect from shock in high voltage applications. Using these safe and reliable rivet solutions and production processes in EV battery cells improve vehicle reliability, reduce cell costs, and can facilitate single source sealing rivet and automation machine processes.

Ensuring Operator Safety

The extraordinarily high voltage of commercial EVs—from the hundred to the thousands— necessitates special solutions that protect operators and manufacturing personnel from electrocution. To that end, SEF is making new developments in non-conductive tools and fasteners as well as exploring non-conductive final coatings to minimize risk of shock. In addition to adopting non-conductive components, all manufacturing operators will need to undergo safe practices training and use special tools. Any costs associated with these practices will be more than offset by the gains in safety and reductions in accidental shocks.



Conclusion

STANLEY Engineered Fastening is uniquely positioned to support the commercial EV market, and to partner with both startup and legacy OEMs as they move into this space. After many years working in the ground transportation industry, SEF has gained recognition as experts in fastening, assembly, and industry applications.

SEF is meeting new challenges in electrification through 'customer backed innovation,' meaning the company maintains close interaction with engineers on the customer's side, working together to develop the best possible solutions. The SEF electrification fastening and design experts are innovating with customers, suppliers and vendors to generate solutions specific to new electrification challenges. In many cases, the resulting fastening, tool and equipment applications and solutions can translate over to truck, bus, van and fleet and utility vehicle EV initiatives.

Finally, in a time of supply chain disruptions and uncertainty, SEF offers the logistical advantage of factories across the world that help to limit the impacts of market disruptions for customers.

The Tucker stud welding process controls quality by using advanced monitoring capabilities and instant feedback.

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