GREENLIGHTING A NEW ERA FOR US TRANSPORTATION

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Transportation

THE EV AND TELEMATICS HORIZON: 2023–2030

- **Heavy-duty transport is a critical sector to decarbonize.**[1] While heavy-duty electric trucks account for only 2.7% of all US trucks, they amount to almost 22% of fuel use from the trucking sector and 7% of total road transport emissions.
- **Large-scale charging infrastructure investment over multiple years is needed** to build the necessary infrastructure to support early adopters and a scalable solution as electric vehicle (EV) utilization increases. In all likelihood it will take more than a decade (potentially longer) to build the infrastructure for a full conversion of electric semitrucks and efficient charging networks.
- **Electric charging rates versus cost of diesel will steadily decrease year-on-year** and likely to offer as much as 50% to 60% cost reduction in time.
- **Battery capacity improvements and increased mileage range** will deliver a sustainable EV solution as the sector continues on its decarbonization transition path. Inadequate infrastructure remains the most significant barrier to fully realizing the commercial opportunity delivered by EVs.
- **Telematics[2] and onboard technology** is enabling driver training and improved safety protocols, optimizing maintenance schedules and delivering efficiencies and increased productivity. Despite pushback from experienced drivers on "Big Brother" style technology, given the pace of digitization and increased compliance requirements, telematics will continue to evolve and deliver enhanced connectivity between operations, route management, and vehicle maintenance teams.

Overview

Electric trucks and greener transportation alternatives have been a talking point in the industry over the past decade, accelerated by climate change concerns and the drive to decarbonize the sector across road, rail, air, and sea. Trucking manufacturing companies have stepped up to the challenge by launching a range of heavy-duty electric trucks, urban e-trucks and hydrogen-electric semitrucks.

The US transportation sector is one of the major contributors to pollution — noise and environmental. While the industry is one of the highest revenue generators in the country; generating $940.8 billion in gross freight revenues in 2022,[3] the calls for sustainability and reducing emissions to combat global warming has become top priority for transportation executives in 2024.

Positives and challenges associated with electric vehicle (EV) fleets include:

1. **Decarbonization and reduced environmental impact**, by replacing dependency on traditional fuel sources, and improved noise pollution.
2. **Range and battery capacity limitations** — although progress is being made to deliver a >500 mile capacity better, current EV truck options are generally viewed as better suited for short haul journeys (<100 miles). Charging times, which can be anything from 30 minutes to several hours depending on the vehicle and battery size, impact delivery schedules and response times.
3. **Inadequate charging infrastructure**, and deep investment required over the next decade to drive industry transformation towards "greener" options.
4. **The cost structure of the electricity used to charge EVs**, which in some use cases is higher than using diesel.

As global export markets continue to navigate geopolitical tensions alongside emerging growth opportunities, the onshoring and nearshoring of operations (particularly in the manufacturing sector) is translating into shifts in freight transportation demand, including the building of new production plants, transportation hubs and an increased volume of last-mile, less-than-truckload (LTL) and warehouse to customer deliveries, in an attempt to reduce operating costs and improve supply chain resilience.

Technology and ongoing digitization of the sector is enabling business operators (and their supply chains) to optimize their operating model, while the ability to track and monitor vehicle performance, and driver road safety is delivering increased productivity and efficiency. Onboard telematics systems, collecting and analyzing real-time vehicle data, offering actionable insights into vehicle performance, battery health, energy consumption, and driver behavior are also positives in the mix.

Trip planners now have access to advanced algorithms to factor in charging station availability, traffic conditions, and energy consumption to provide accurate and efficient route recommendations. Predictive analytics can learn from historical data to estimate battery degradation, predict maintenance needs, optimize charging schedules, and identify potential issues before they occur. Fleet management software enables managers to manage their commercial EV fleets efficiently with the help of vehicle tracking, driver performance monitoring, maintenance scheduling, and energy optimization.

This whitepaper explores three perspectives:

1. **Current perceptions** on the transportation sector's switch to greener fleets
2. **The reality** — opportunities, challenges, and risks
3. **The future roadmap**, including perspectives on what this means for the consumer and transportation operators

Perception

1. The future of freight transportation is electric — rapid adoption is fueling the change

Perspectives and opinions vary on the advantages of transitioning freight fleets to electric semitrucks.[4] With major fleets committing to transitioning at least 30% of their new heavy-duty truck purchases to be zero-emission vehicles,[5] including electric models by 2030, increased vehicle options and innovation, improved charging infrastructure, and policy incentives all point to a near-term boom in EV freight truck adoption.

2. Telematics are key to safer driving and reducing auto insurance premiums

Telematics offer a valuable solution amidst rising commercial auto premiums and increased loss severity. By providing enhanced access to data, the telematics component monitors on-road performance, driving safety, and aids in risk management. Two integral components are crucial:

1. The telematics piece offering data; and
2. A robust reporting structure for efficient risk management.

Understanding how driver performance impacts vehicle efficiency enables targeted improvements in fuel economy and driving speeds. Over the past decade, technology has advanced from gyroscope-based collision avoidance to static credits (e.g., 5% to 10% premium reduction) for installing telematics, fostering safety and risk management without constant oversight.

By collecting "real-time" vehicle data, transportation fleet operators are able to track average vehicle speeds, battery charge status, idle time, total distance covered, driving time, vehicle performance, accidents, and more. This data can then be analyzed to detect potential issues before they occur and predict when maintenance is required, thereby saving time and money.

3. Reduced maintenance, repairs, and operating costs

EVs outperform internal combustion engine (ICE) vehicles in long-term fuel and maintenance costs. Over five years, an ICE vehicle costs $9,490 in fuel, while an EV's charging cost is $4,295 for the same distance.[6] With fewer moving parts, EVs require less maintenance, avoiding frequent oil changes. Though initial costs may seem higher, market competition, improved supply chains, sustainability, and charging affordability make EVs a superior long-term choice. Subsidies to support the purchase of EVs are an added incentive to motivate the switch to greener vehicle options.

4. Federal government funding is powering the transition

Federal policies, investments, and incentives are in supporting the growth of the US commercial EV market. President Biden has shown his commitment to advancing the EV future through the 'Investing in America agenda'[7] and a $15.5 billion Department of Energy package of funding and loans primarily focused on retooling existing factories for the transition to electric vehicles (EVs). The Bipartisan Infrastructure Law will invest $7.5 billion in building a network of 500,000 EV chargers; more than $7 billion to provide critical minerals and components to domestic manufacturers; and more than $10 billion for clean transit and school buses.[8] The Inflation Reduction Act will give incentives for buying new and used EVs along with grants for deploying zero-emission heavy-duty vehicles.

The CHIPS and Science Act will provide investment for building semiconductors domestically. Involvement from the government is echoed by private sector investments as well. Since President Biden took office, the number of EVs sold in the US has tripled. Manufacturing companies announced an investment of $13 billion for EV manufacturing in 2022 — 3x the investment made in 2020.

For businesses buying an electric truck, the IRS has introduced the Commercial Clean Vehicle Credit offering a tax credit of $40,000 if the vehicle in service is heavier than 14,000 pounds. The law also includes the Clean Heavy - Duty Vehicle Program which provides $1 billion of funding to municipalities, states, tribes, and nonprofit transportation association for electrifying heavy-duty fleets.[9]

A September 2022 White House briefing offers further perspective. "Since November 2020, companies have invested nearly $85 billion in manufacturing of electric vehicles, batteries, and EV chargers in the US.[10] In 2022, companies have announced $13 billion in domestic EV manufacturing — more than triple the investment in 2020. Companies have also announced $24 billion in batteries — more than 28 times the investment in 2020 — and over $700 million to support EV charging. The number of electric vehicles sold in the US has tripled since the President took office."

Reality

1. EVs are the greener option — balancing expectations

The perception of EVs being "fully green" has become somewhat muddled. The Union of Concerned Scientists reported that the production of fully working long-range electric vehicles emits 68% more carbon as compared to gasoline cars.[11] EVs run on lithium-ion batteries involving rare metals and minerals that are often sourced through environmentally-invasive mining techniques.

From a battery and mileage perspective, an EV needs to run for many miles before it can be termed as "fully green" and better for the environment. A study by TRATON Group revealed that an electric truck would need to run about 68,000 kilometers to break even with its diesel counterpart.[12] This is because EVs are still dependent on electricity from the grid to charge their batteries. And this electricity grid might not be fully renewable as it uses fossil fuels or other sources that emit greenhouse gases.

Despite visible progress being made, a full transition to EV fleets is distant. It will most likely take decades due to high costs, operational changes, and the need for freight businesses to gain confidence that the investment will be cost-effective. To put this into context, EV trucks constitute roughly 1.7 million versus 284 million conventional fuel trucks currently on the road (approximately 0.59%[13]). That said, there is no escaping that EVs ultimately represent the future.

2. Telematics and the 'Big Brother' age is not universally welcomed

Historically, the key challenge with integrating telematics systems into vehicles has been the driver not wanting Big Brother monitoring their every move, with inward-facing and outward facing cameras analyzing and assessing driver capability and road safety. The push back from drivers of all experience levels is now overridden by increased emphasis being placed by transportation operators on the commercial benefits, including showcasing best practice driving and risk management at play.

AI has been signaled as a game changer. Systems can now read road signs and knows when a driver runs through a red light or breaks the speed limit. The AI component takes a picture, flags it and sends a correspondence immediately to the driver. Then, either the driver trainer, the dispatcher, or the risk manager uses the information to provide coaching/training and a driver score is allocated.

A number of positives flow through to partnerships between the fleet operator and the insurer, who now have visibility of loss data — severity, frequency, and prevention — and are able to make a more commercial judgment on premium reductions, year-on-year.

3. Total cost of ownership (TCO)

While the upfront cost of EVs may be higher than that of traditional ICE vehicles, the lower fuel and maintenance costs over the vehicle's lifetime can offset this difference. AAA, a federation of motor clubs providing various automotive-related services, calculates that maintaining a non-electric vehicle costs nearly $1,279 per year as compared to $949 per year for an electric vehicle.[14]

According to a study by the Lawrence Berkeley National Laboratory, a Class 8 electric truck with a range of 375 miles and covering 300 miles a day will offer a 13% lower total cost of ownership as compared to their diesel counterparts. They also offer about 3-year payback and savings of nearly $200,000 over 15 years.[15] The Department of Energy also calculated around 40% less maintenance costs for a battery-electric light-duty vehicle.[16]

As a truck's average daily mileage increases, larger batteries are needed to ensure the truck's daily energy needs are met based on a variable use case — short-haul journeys versus longer journeys that place increased demands on the vehicle. While larger batteries increase the upfront price of EV trucks,[17] higher average daily mileage improves the operational costs when compared with diesel counterparts. Overall, battery electric trucks are expected to record a better TCO for average mileages as high as 750 miles per day, provided that the day-to-day mileage variability is low.

4. EVs lack the necessary torque to pull heavier freight loads

EVs face upfront challenges — insufficient torque for heavy cargo and limitations in long-distance travel due to temperature variations affecting battery performance. This reduces efficiency and extends delivery timelines, hindering adoption by larger multistate operators who find the current vehicle design economically unviable for their operating models in 2023. Battery weight, as manufacturers look to increase range and torque, is an added challenge. The heavier the batteries, the lower the allowable freight weight.

With a typical diesel-engine freight truck being able to haul around 40,000 to 50,000 pounds of freight (depending on configuration and trailer type), current EV truck builds are no match for this capacity and a multi-vehicle response would generally be required to provide equivalent capacity. Sections of the transportation industry remain skeptical of the feasibility of EV trucks longer term and suggest green hydrogen is the more commercially viable option.

5. EV production capacity is building in the US to increase supply chain resilience

Full decarbonization of the transportation sector is on the horizon but requires further progress. Despite ongoing discussions, the shift to greener transportation is steadily gaining momentum. Increasing EV production capacity[18] globally, in countries including India, South Africa, Thailand, the UK, China, Spain, and South Korea, is shaping a market served by several major players.

While the US is steadily establishing EV production plants, a supply chain imbalance exists for EV components. There remains a strong dependence on international suppliers and if EV manufacturers are sourcing batteries and other components from less eco-friendly markets, then the transition to EV fleets may be driven more by commercial motives than a genuine commitment to environmental sustainability.

EV production requires conventional fuel to build the vehicles and transport them to the US. Although production plants are springing up on American soil, the reliance on fossil fuels remains and realistically it will be at least a decade before broad-scale carbon footprint reduction is achieved, maybe further.

6. Charging infrastructure challenges are hampering progress

Despite increased investment in EV charging stations, both number and network reach falls considerably short for an all-electric transportation fleet, particularly for long-haul trucks that require different connector standards and frequent charging stops on routes due to heavy freight loads, larger batteries, and higher charging power requirements.

According to a report by the Environmental and Energy Study Institute (EESI), there are only 6,700 public DC fast-charging stations in the country, and most of them cater to passenger vehicles only.[19] The absence of a widespread heavy-duty truck-charging network limits the regions electric trucks can cover. While companies such as TeraWatt Infrastructure are pouring millions to build a network of fleet chargers on major routes along the East Coast and West Coast, it will take up to a decade for the newly implemented infrastructure to become fully operational, closing off access to interstate corridors and/or rural areas where most of the freight movement occurs.

The Alternative Fuels Data Center reports that there are only 147,629 charging ports and 56,256 charging stations in the US as of 2022.[20] The US government is investing heavily across the country and Puerto Rico to develop the direct current fast charging (DCFC) and level 2 chargers infrastructure for electric vehicles.

7. Supply chain vulnerability

News of a key electric truck manufacturer filing for bankruptcy[21] in October has dealt a blow to anticipated EV truck production volumes, after its production targets were hit by the demise of its battery supplier,[22] who also filed for bankruptcy in August. With the truck manufacturer set to scale up in the US market, this latest development highlights the vulnerability of manufacturers seeking to drive volume as the market grapples with tighter capital markets, reduced investor appetite and increased uncertainty.

Perspectives and Connected Risks

The reality check

Growing concerns over climate change impact and air pollution are continuing to grow, consumers and automakers are increasing their efforts to introduce environmentally friendly vehicles to deliver sustainable and resilient supply chains. Manufacturers are launching new models and increasing spending on EV technology. A Grand View Research report estimated the commercial EV vehicle segment to expand at a CAGR of 45% in terms of revenue.[23] An EY research report estimated the number of electric vehicles to jump from 2 million in 2020 to 88 million in 2050, comprising 65% of the total vehicles in the US.[24]

Practical limitations for EVs and telematics

While the demand for electric vehicles and telematics in the trucking industry is increasing, it's not all smooth sailing. There are several restraining factors that can slow down the rate of transformation.

One of the biggest driving factors is the high upfront cost of buying an electric vehicle along with installing advanced telematics systems. It is important to note that purchase price and total cost of ownership are two different terms and can vary for both ICE and EVs. Fleet managers must consider the total cost of ownership when comparing EVs to ICE vehicles. When comparing the five-year cost of owning a vehicle, Kelley Blue Book did a survey in February 2023 and found that while traditional gas vehicles would cost a consumer $56,962 on average, an EV would cost $65,202 over the same period.[25]

The trend continues for financing as well, with the average cost of financing an ICE vehicle is $3,247, while that of an EV is $4,583. The largest recurring cost after purchasing a vehicle is insurance, and here also, EVs trump ICE vehicles. The average collision and liability insurance cost for an ICE vehicle is $5,707, and for an EV is $6,824.[26] These costs are inclusive of the vehicle's price and its cost for repair, both of which are higher for EVs as they incorporate newer technology.[27]

Roadmap for change

The road toward complete transformation to electric trucks is not a simple or straightforward one. It is riddled with challenges and requires collaboration among different stakeholders such as government agencies, manufacturers, service providers, and consumers. Some of the key steps that may be needed for this transformation to occur are:

1. **Conducting field research and data analysis** to figure out the most suitable routes and segments for electrification and understanding the current trucking landscape. This may include collecting data about driving patterns, cargo types, fuel consumption, frequent detours or halts, vehicle profiles, loading techniques, and more. Some freight corridors can be identified that are suitable for conducting pilot projects and bringing about change gradually.

2. **Accelerating the development and innovation of electric trucks** that meet the trucking industry's performance, cost, and reliability requirements. Creating national standards for developing vital technologies such as batteries, motors, chargers, and connectors would bring standardization among manufacturers and trucks being developed.

3. **Building and expanding charging infrastructure for electric trucks** across the US requires close collaboration from the government as well as private sector companies to create a nationwide network of fast-charging stations along highway corridors and in urban areas. Integrating charging infrastructure with the electricity grid, modernizing the grid with renewable energy sources, and efficient disposal/recycling of batteries is vital for complete transformation.

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About the author
Chris Demetroulis
Managing Director, Transportation
LinkedIn
(816) 329 0815

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