WHITE PAPER

How the Automotive Electrification Trend Impacts Packaging in North America

A renaissance in electric vehicle ownership and usage is driving more OEMs and part suppliers to reconsider the way they package and ship a wide variety of electric and electrified components.

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HOW THE AUTOMOTIVE ELECTRIFICATION TREND IMPACTS PACKAGING IN NORTH AMERICA

On the road since the late-1800s, electric autos accounted for one-third of all vehicles on U.S. roadways by 1900—the year that 1,575 of the 4,192 vehicles produced in the U.S. were electric. Sales of electric vehicles remained strong and provided a launch pad for fledgling automakers like Oldsmobile and Porsche, but that momentum slowed over the first few decades of the 20th century. Thwarting the electrification trend was a movement to use electric starters (a process that supplanted hand-cranking to start gas engines) and, subsequently, the introduction of internal combustion engines.

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>
> — The Institute for Local Self-Reliance (ILSR)

Fast-forward to 2018 and we can see that automotive electrification has not only come full circle, but that it now integrates a wide array of advanced technologies and innovations that engineers in the 1800s couldn't have dreamed of—let alone produce. According to the *International Energy Agency's Global EV Outlook 2018*, sales of new electric vehicles (EV) hit record highs last year, surpassing 1 million units—up by 54% over 2016. The global stock of electric passenger cars reached 3.1 million in 2017, representing an increase of 57% from the previous year (similar to the growth rate of 60% between 2015 and 2016).

"Electric vehicles represent a titanic shift in the transportation sector, a back-to-the-future moment where battery-powered vehicles can reclaim the position of most popular drivetrain," the Institute for Local Self-Reliance (ILSR) points out in *Choosing the Electric Avenue: Unlocking Savings, Emissions Reductions, and Community Benefits of Electric Vehicles*. "Their adoption has many significant implications, from the de-carbonization of transportation by enhancing renewable electricity use, to widespread opportunities to improve electric grid efficiency with distributed energy storage."

With momentum also comes challenges. Two main challenges for electric vehicles are their overall range (EV current approximate range is 300 miles) and the time it takes to charge them (50-90 miles in every 30 minutes, or approximately four hours for 300 miles).

In this white paper, we explore two different aspects of the auto electrification trend, tell how supply chains will need to flex and adapt to these changes, and explain how electrification impacts packaging and the automotive manufacturing supply chain as a whole.

The two faces of auto electrification

In a world where the traditional rearview mirror is giving way to the backup camera, the automotive electrification trend is impacting every link in the supply chain right now. Driven by policy mandates and environmentally-conscious auto owners, sales of electric vehicles are expected to hit 4 million by 2020, according to the IEA, which says the global stock of these vehicles will reach 13 million by 2020 (and 21.5 million by 2030).

This double-digit growth is forcing auto manufacturers and their suppliers to rethink the way vehicles and components are designed, engineered, and delivered. Within the auto segment, electrification impacts manufacturing and distribution in these two distinct ways:

1 **The evolution of electrification systems within the vehicles themselves.** Today's vehicles have more sensors than ever, from parking assist sensors to cruise control sensors that automatically slow the car down when it gets too close to the rear of another vehicle on the highway. The movement to incorporate more electrification into cars—including those that run on conventional internal combustion engines (ICEs)—has been in full force for the last 10-20 years.

2 **The electrification of the vehicle's powertrain.** This is the fundamental shift away from reliance on the ICE to some form of electrical powertrain, powered by batteries. No longer solely reliant on fossil fuels for transportation, drivers instead plug their cars into private or public chargers. Originally conceived in the 1800s, the powertrain electrification trend has picked up speed in recent years thanks to the efforts of policy makers, auto manufacturers, and eco-conscious consumers. Europe and China are leading the way in this area.

Each of these larger trends impact the automotive supply chain in different ways, and neither is expected to slow down anytime soon. On the systems side, for example, consumers are demanding better safety features, more bells and whistles, and improved convenience. Lane departure warning systems, for example, warn drivers when a vehicle begins to move out of its lane (unless a turn signal is on in that direction) and are designed to minimize accidents by addressing the main causes of collisions: driver error, distractions and drowsiness.

Making cars safer

Electrification is also playing a part in vehicle maneuverability, and making it easier for drivers to gain clear views of their paths while in reverse. By providing a bird's eye view of their surroundings in a parking lot, for example, these back up cameras easily surpass what the average person can see with the naked eye.

"Electrification is making things easier, safer, and much more convenient for drivers," says Scott Krebs, marketing manager at ORBIS Corporation.

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Accommodating these and other advancements in automobile technology not only requires forward-thinking design and engineering teams, but it also necessitates some key shifts in the way participating companies run their logistics and supply chain operations. Part suppliers, for example, are designing and producing more innovative and integrated components that have higher price tags—a reality that directly impacts how those items are moved, protected, and tracked as they move across the supply chain.

Unlike Ford's largely homogenous Model T assembly line, the electrified automotive supply chain is also highly customized and personalized. "The days when identical cars moved down the assembly line together are gone," says Krebs, " and have been replaced by a line where every other vehicle is slightly different than the next. That's driving new complexities in terms of the many different components that go into a car."

Optimizing auto component shipments

With the electrification trend in full swing across all vehicle manufacturing sectors right now, supply chains as a whole are becoming increasingly complex. The market is asking for more features in vehicles based on driver safety and overall experience. Automotive companies are responding with increased options and higher level of electrified components. The manufacturer that relies on a combination of Tier 1, 2 and 3 component suppliers, for instance, not only needs visibility over *all* of those vendors, but it also needs to keep track of different versions of its vehicles components.

For decades, the auto industry has relied on reusable tote/pallet systems and bulk packaging to store, stage and move parts to the assembly line. The standardization and reusability enabled significant efficiency and productivity in the supply chain. Now, packaging will be going to the next level to drive even more optimization and part protection. In today's world, these complex components require more protective packaging," says Krebs, "they must be shipped in a way that protects the sensitive electronic components. For example, automotive companies are driving weight out of cars and historical protective housings are being downgraded, putting more importance on protective packaging ensuring parts arrive for assembly in good quality."

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With higher supply chain costs driven by increased shipping costs and higher cost components entering the supply chain to only name a few, companies are looking for ways to become more efficient and lower supply chain costs.

One focus is on moving more components within the current standard shipping mode of 53' trucks. Using a standard (48" x 45") footprint today you can fit 26 positions in a 53' truck. Historically the 48"x45" footprint was optimized for 48' trucks. Today, with all of the new 53' truck fleets, the packaging is changing to once again optimize truck density. Developed with the intent of driving supply chain efficiency, a new size of 44.5"x48" packaging is allowing 28-positions in a 53' truck.

By modifying the packaging slightly, and by taking the outside diameter (OD) of the package and shortening it slightly to be 44.5" in one direction, shippers can pack more into a trailer. And by adding RFID, Bluetooth, and other smart container technology to the packaging, component shippers and their customers gain a highly traceable, completely optimized shipment that can be tracked as it moves across the supply chain.

"When you can get 14 skids in two rows, 28 positions, in the trailer, and then add advanced tracing capabilities to the mix," says Krebs, "that same truck becomes more efficient and trackable as it carries more components through the supply chain."

The fundamental shift in thinking continues

As the fundamental shift away from reliance on the ICE to some form of electrical powertrain continues, the Nissan LEAF, BMW i3, Tesla Model S, and the Chevrolet Volt/Bolt have led the way for the electric car evolution in North America.

Look under the hood of those cars, however, and you'll see a wide variety of engine components coming together to create a large assortment of electric and hybrid engines. Where one car may feature a small ICE and an electric motor backup, for example, another may be 100% electric.

Here's a breakdown of how each option works:

- Battery electric vehicles run off an electric motor and battery. This offers increased efficiency and allows cars to drive emissions-free when the electricity comes from renewable sources. Unlike ICE cars and trucks, battery electric vehicles can use existing infrastructure to recharge, but must be plugged in for extended periods of time.
- Plug-in hybrid electric vehicles are similar to battery electric vehicles but also have a conventional gasoline or diesel engine. This allows vehicles driving short distances on electricity-only to switch to ICE for longer trips. Although not as clean as battery electric or fuel cell vehicles, plug-in hybrids produce significantly less pollution than their conventional counterparts.
- Conventional hybrids also have conventional engines and an electric motor and battery, but can't be plugged-in. Though cleaner than conventional cars and trucks, non-plug-in hybrids derive all their power from gasoline and diesel, and aren't considered electric vehicles.

While they may sound complex, these different options require a smaller selection of parts and components than an ICE would, but they also impact the entire auto supply chain. A true, 100% battery-operated vehicle like the Tesla Model S, for example, requires numerous small batteries that are then incorporated into a single, large battery package that is installed on the underside of the car. This is one example of a "pure" battery or electric motor.

Vehicles like the Toyota Mirai and the Hyundai ix35 FCEV use hydrogen fuel cells—an innovation that introduces even more complexities into the supply chain and in how the components and batteries are safely packaged and shipped.

What does all this mean for reusable packaging? As automotive components evolve, the packaging used to move them will also evolve. In addition to the sheer increases in sensors in today's vehicle, batteries for electric vehicles are going through lightening-fast advancements, so battery transport will be more important than ever.

With the wide variety of batteries being developed, from hydrogen fuel to lithium ion, each has different handling and safety requirements. This will impact the design, size and style of packaging, as well as how packaging is managed and tracked in the supply chain. This evolved packaging, combined with technology to enable supply chain visibility, will help today's automakers enhance their supply chain and logistics to better meet the needs of consumers.

"Automotive OEMs and their tiered suppliers have a lot coming at them right now, trying to figure out how to run these new-age supply chains in a world where customer demands and expectations change daily," says Krebs. "With evolving packaging solutions, leveraged with connected track-and-trace capabilities—whether that means applying a simple label to a box or using a high-end GPS tracker—OEMs and part suppliers alike can develop flexible packaging approaches and create a streamlined, efficient supply chain."

About ORBIS Corporation

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