

CHALLENGES AND OPPORTUNITIES IN

Electromobility for Medium and Heavy-Duty Vehicles

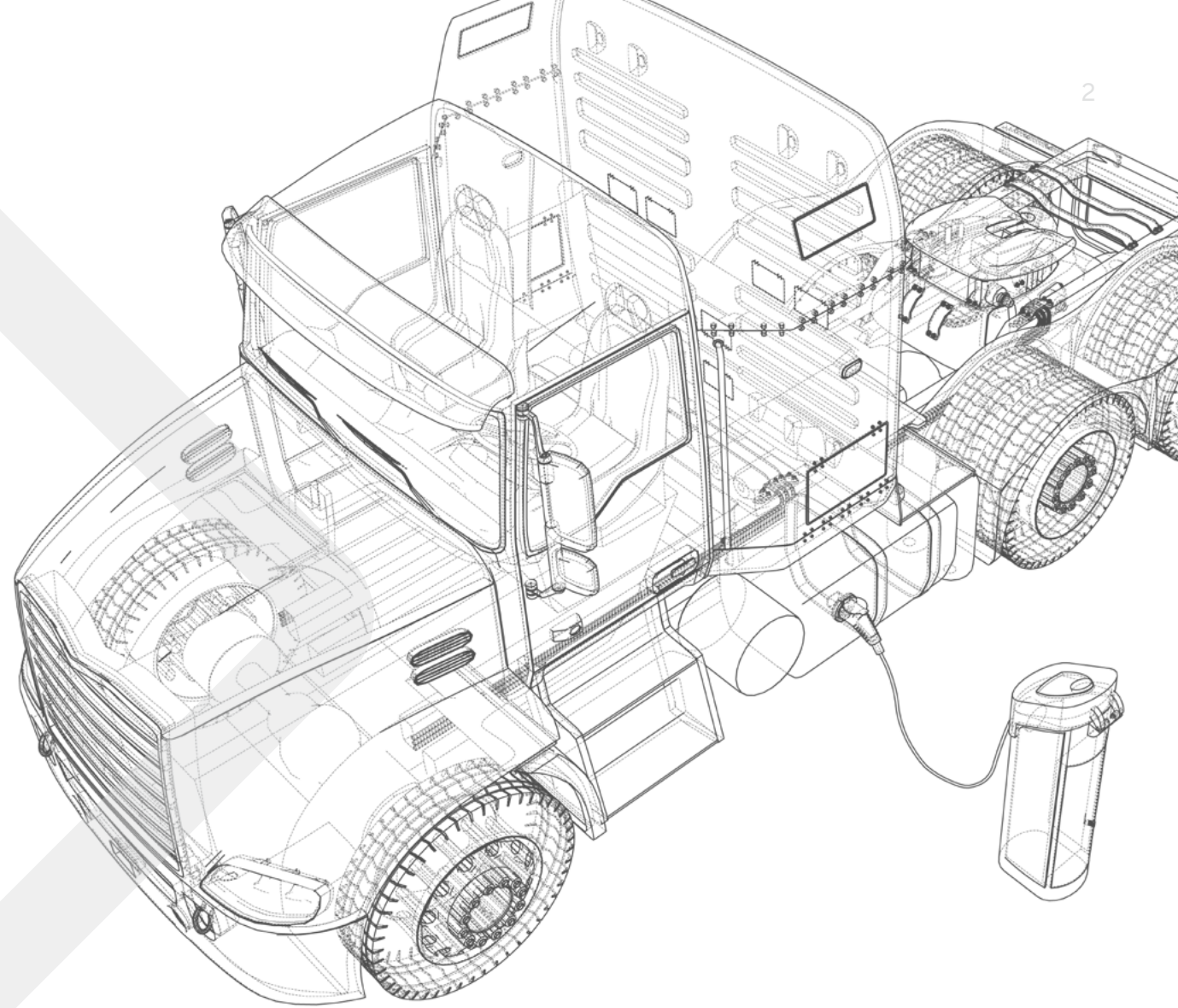


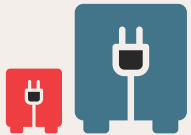
EWI®

E-MOBILITY READINESS FOR TRANSPORT VEHICLES

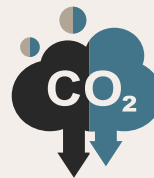
Technology at the Tipping Point

As industry starts manufacturing more medium and heavy-duty electric and fuel-cell trucks, the issues of payload and range raise the biggest concerns. Payload determines the economics of a transport system. Range defines its utility. Both factors depend on lightweighting and battery reliability, and thus create new challenges for the makers of electric and hybrid transport vehicles.

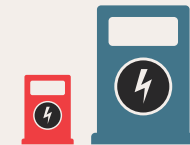




The U.S. electric truck market size was \$308.9 million in 2021. From 2021-2030, it is expected to expand at a CAGR of **54.0%** due to increasing government measures to promote e-mobility and strict emission standards on fossil-fuel-powered commercial vehicles.¹



The California Air Resources Board (CARB) is adopting a heavy-duty Low NOx Omnibus Regulation, which aims to achieve a **90%** reduction from current NOx emissions limits by 2027.²



Along with massive development of charging and refueling infrastructure, the sales share of battery-electric and fuel-cell-electric heavy-duty trucks will have to scale up rapidly from below 1% in 2020 to **30%** in 2030 to meet new standards.³

E-Mobility Challenges: Electric and Fuel Cell Trucks

BATTERIES



Weight. Batteries, a major component of overall weight in electric transport systems, will require tradeoffs between increased capacity for range and reduced payload values.

New Materials. Near-term developments such as anode/cathode material variations and improved chemistries will improve vehicle batteries. Next generation developments like solid-state and 3D batteries could alter existing paradigms completely.

Predictive modeling and testing. Ensuring reliable cell interconnections will require new technologies to improve first time quality and new nondestructive test methods for identifying problematic joints.

Integrated assembly. Migration from self-contained battery cells assembled into packs toward integrated designs will enhance in battery system capability, serviceability, and long-term survivability.



E-Mobility Challenges: Electric and Fuel Cell Trucks

POWERTRAINS AND E-DRIVES



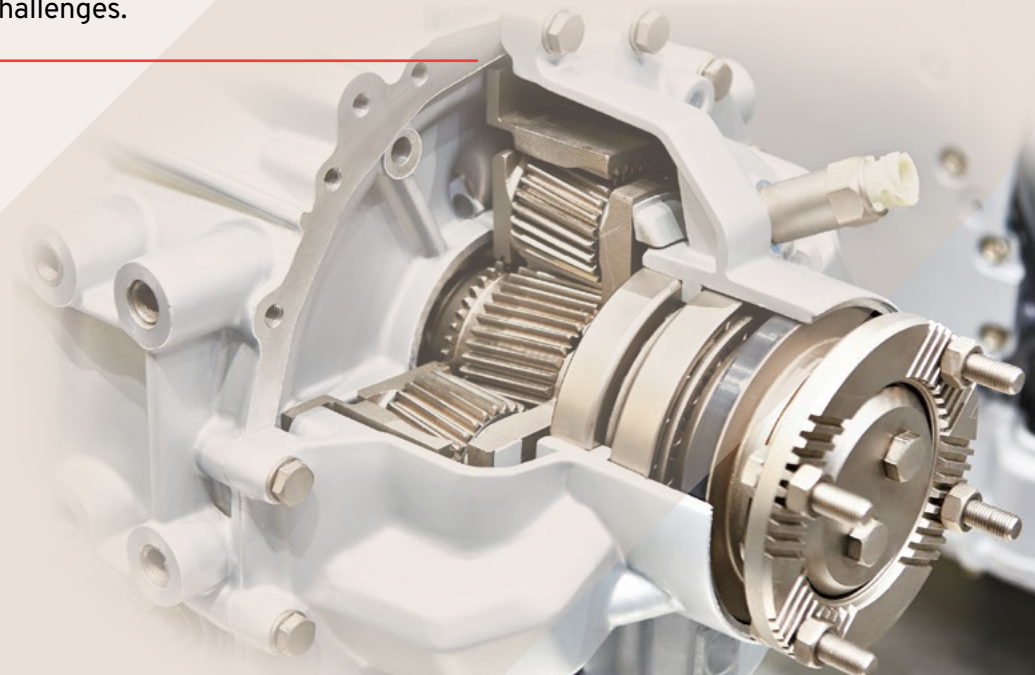
Higher operating speeds. E-drive motors currently operate at speeds up to 23,000-RPM. Plans to increase these speeds up to 30,000 will challenge both powertrain designs and tolerances.

Increased Power. Stator and rotor assemblies must address higher currents and speeds while reducing costs. New materials and assembly technologies will be required.

Lighter and stronger. Motors must be lightened to reduce rotating inertias while simultaneously strengthened to carry higher primary and induced currents.

New process development. Increasing system voltages from 400-V to 800-V (currently under industry consideration) will reduce required currents and enable package size and weight reduction. These reductions, however, will impact associated manufacturing and assembly processes.

Component design. Converting EV powertrains to transmission systems with high enough motor speeds to drive axles will present both increased gear-precision and weight reduction challenges.



E-Mobility Challenges: Electric and Fuel Cell Trucks

HYDROGEN FUEL CELLS

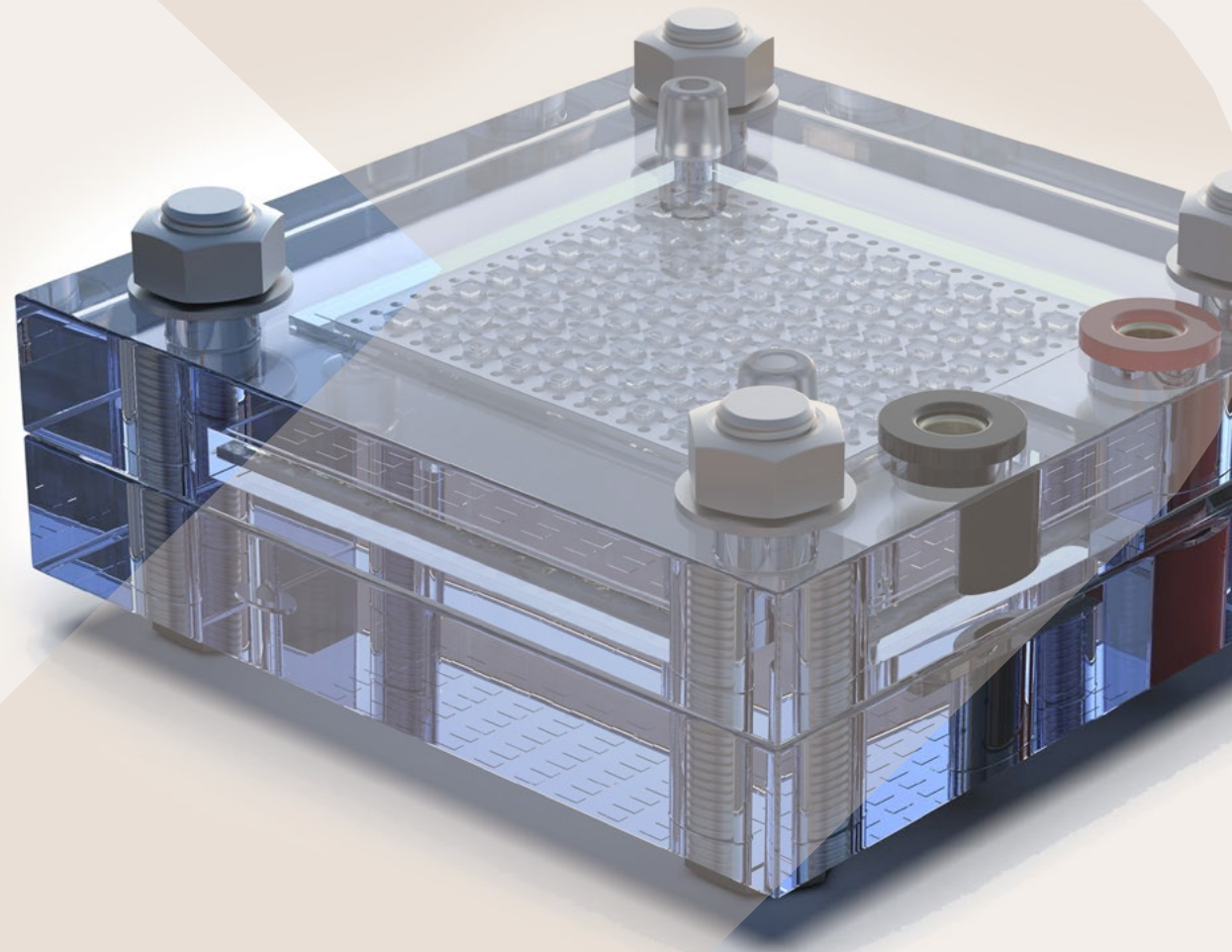


Corrosion concerns. Materials to be wetted with hydrogen require special consideration for resistance to hydrogen degradation mechanisms.

Forming technologies. To avoid necking, cracking, and springback in these multi-layer fuel cells, new forming technologies need to be developed.

Material volume. For each fuel cell stack up built with alternating layers of thin-gal stainless steels, many meter welding is required.

H2 unknowns. Hydrogen distribution, both local to the automobile and as a part of the refueling system, must be designed specifically for the unique material challenges of hydrogen service.



E-Mobility Challenges: Electric and Fuel Cell Trucks

STRUCTURES



Lightweighting. Gross vehicle weights for heavy truck are approaching 40 tons. Developing and integrating alternative lightweight, higher-strength materials could contribute to overall weight reduction.

Crash modeling. Understanding crash behavior is complicated by the range of available materials as well as candidate assembly technologies. Improved predictive tools are key to defining optimal designs.

Protective enclosures. Battery protection, particularly in a crash event, is a primary goal in electric vehicle structural design. Unique designs of battery enclosures, active vs. passive box approaches, secondary crash protection need to be considered.



BRINGING ELECTRIFIED MEDIUM AND
HEAVY-DUTY TRUCKS TO MARKET

FINDING THE RIGHT EXPERTISE

The complexities of vehicle electrification require advanced approaches to welding and joining, material selection and validation, control technologies, and quality testing. **Where can your development team get help to meet the rapidly shifting requirements of vehicle electrification?**



Get the support you need to...

IDENTIFY THE RIGHT APPROACH

EWI offers a range of expertise, services, methodologies, and facilities to help you create your plan and process before investing time and money into untested programs.

Our engineering expertise covers a wide array of assembly technologies, with demonstrated experience in the electric vehicle market. Client services range from creation and demonstration of new technologies to direct manufacturing support. Methodologies include sophisticated

testing approaches, numerical tools, and data management strategies that can be scaled to individual challenges. In addition, EWI maintains a fully equipped development facility with systems to cover the range of joining, forming, testing, and nondestructive methodologies.



Get the support you need to...

ACCELERATE YOUR PLATFORM LAUNCH

When it comes to supporting accelerated scale technology development and implementation, EWI has a proven record of success.

Examples include the use of design of experiments and numerical modeling tools for generation of performance databases, application of machine learning for process quality enhancement, adaptation of new technologies for critical EV components, and more. The application of these approaches has helped manufacturers reduce performance database

development time by as much as 90%, rapidly integrate next generation material systems, create processing maps for accelerated optimization, and improve quality assessment of manufactured components. Partnering with EWI can help your company apply new technologies for evolving vehicle sub-systems and help you bring your innovations to market successfully **on time and on budget.**



EWI — AN EXTENSION OF YOUR ENGINEERING TEAM

WHAT IS YOUR KEY CHALLENGE IN E-MOBILITY?

EWI provides comprehensive engineering services to help companies identify, develop, and implement the best options for their specific applications. With unmatched expertise, state-of-the-art lab facilities, and technology resources, we offer customized solutions that deliver game-changing results.

Contact EWI today to explore the best options and find the right solution for your application: **info@ewi.org** or 614.484.7600.



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SOURCES

¹<https://www.psmarketresearch.com/market-analysis/us-electric-truck-market>

²<https://www.alliedmarketresearch.com/electric-truck-market-A06183>

³<https://www.iea.org/reports/trucks-and-buses>

