

Off-Road Construction Equipment Manufacturers Can Move to an Economically and Environmentally Viable Future





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When did the push-pull between construction equipment manufacturers' commitment to the environment and their bottom line start? Let's say it began in 1839 with the invention of the steam excavator. Off-road construction vehicle manufacturers were already thinking about how to balance the work they needed to do and where it needed to happen.

The particular challenges presented by construction required specific solutions. Diesel worked well for large-scale construction equipment, for example, because of the engine's reliability, efficiency, durability, and torque.

But now, as our environment changes, we are under new pressure to limit noise and particle pollution and scale up emissions regulation. Engine manufacturers face obtaining emissions approval before their engines go onto the market. But while increased regulation may seem like a hindrance, extra care is good for business.

Manufacturers can protect people's health, maintain air quality, ensure a market for more sustainable engine types, and help avoid unfair competition from non-compliant, low-cost products in global markets.

Why Economics and the Environment Remain at Odds in Construction

The historic challenges of balancing the off-road equipment sector's economic and environmental issues are at a tipping point right now. Manufacturers need to assess the cost of raw materials, the benefit of energy efficiency, available production technology, and how those solutions' maturity and reliability stand up to the tasks at hand and existing technology.

The industry has been evaluating different options for these energy alternatives. For example, rapeseed oil fuel and biodiesel are emerging as promising alternatives to diesel fuel in agriculture and forestry. Furthermore, hydrogen fuel cells are less advantageous because of the high cost of retrofitting production facilities and non-road mobile machinery.

Still, as we assess and identify diesel alternatives, the need for electrification is growing thanks to the rising demand for renovation. The recently passed <u>Bipartisan Infrastructure Law</u> will lean heavily on the country's manufacturing professionals to deliver the equipment needed to fulfill the legislation's promises affordably and sustainably.

Electrification can do both. And all its elements — from the massive electric vehicles that will power the progress to the tiny fasteners that make that movement possible — will factor heavily in that progress.

Bipartisan Infrastructure Law Highlights

Invests \$350 billion in highway programs over 5 years
 The Bipartisan Infrastructure Law provides the basis for FHWA programs and activities through
 September 30, 2026. It makes a once-in-a-generation investment of \$350 billion in highway
 programs. This includes the largest dedicated bridge investment since the construction of the
 Interstate Highway System.

- Creates more than a dozen new highway programs
 New programs under the Bipartisan Infrastructure Law focus on key infrastructure priorities
 including rehabilitating bridges in critical need of repair, reducing carbon emissions, increasing
 system resilience, removing barriers to connecting communities, and improving mobility and access
 to economic opportunity.
- Creates more opportunities for local governments and other entities Many of the new programs include eligibility for local governments, Metropolitan Planning Organizations (MPOs), Tribes, and other public authorities, allowing them to compete directly for funding.

Fasteners, Where Do They Fit?

Every vehicle seen on a construction site is the sum of all its parts. Fasteners are some of the smallest in size, but their combined efforts loom large in building durable vehicles — especially when you consider that they comprise 50% of a product's SKUs despite representing just 1% of its cost.

What do engineered fasteners bring to the table for your electrified products?

1. Size

With more space-efficient fasteners, electrified equipment can be smaller and lighter in weight. In turn, building smaller products saves production costs on the back end.

2. Insulation

The high temperatures generated by electrified products means your fasteners need protection beforehand. For example, nylon fasteners are preinsulated to protect against thermal and electrical heat.

3. Materials

The material that fasteners use dictates how durable they are and how long they can hold a charge. For instance, aluminum, magnesium, and titanium fasteners make for lighter engines that can improve the distance per charge.

4. Geometry

Shallower fastener heads make for lighter products. Lighter components lead to efficiency gains during production.

5. Non-ferrous

Products with large electrical motors need a current that doesn't stop. A non-ferrous, anti-magnetic fastener made of copper, titanium, brass, or nickel maintains that flow and isn't corrosive.

6. Assortment and availability

As versatile as fasteners are, they take time to deliver — anywhere from 16 to 20 weeks, in fact, for standard fasteners. In addition, by tapping thousands of suppliers worldwide, a partner like Optimas can engineer fasteners to specified requirements and manufacture them at its U.S. and U.K. facilities to cut down on that lag.

At Optimas, we think deeply about how to contribute to creating an Earth-friendly industry, and that begins with how we make our fasteners. To learn more about engineered fasteners for electrified products, download our whitepaper!

Nearshoring Economic and Environmental Impact

When the goal is to balance profitability and sustainability, sourcing and manufacturing close to the delivery destination can help. Nearshoring (aka onshoring) can <u>enable off-road construction vehicle</u> <u>manufacturers to</u>:

Reduce time, cost, and risk.

Even in the best of times, you inherently leave yourself vulnerable to delays or project derailments when sourcing materials from overseas. Right now, those risks are significantly higher than normal. In a <u>survey</u> of U.K. businesses, 41% say they're experiencing significant supply chain delays, shortages, or other disruptions. Even basic supplies take up to 56 weeks to arrive. The farther away supplies are, the more complex (and costly) your supply chain is likely to be.

• Minimize problems.

The longer and more complex your supply chain is, the less control you have in overcoming potential barriers. Firms have seen issues with shipments (e.g., late arrivals, transportation issues, etc.) from other continents negatively impacting their production and profits.

Lower carbon footprints.

It should be obvious, but <u>reducing the distance</u> your parts and fasteners have to travel, in turn, reduces your carbon footprint. Every act of transportation required to get your supplies through the supply chain to your manufacturing site has an environmental cost. Reshoring — the process of returning to sourcing carefully selected parts from onshore suppliers rather than offshore suppliers — can help address the balance.

With supply chain issues posing some of the biggest challenges to off-road construction vehicle manufacturing, <u>reshoring</u>, <u>onshoring</u>, <u>or nearshoring</u> are quantifiable strategies for increasing availability, staying on schedule, and meeting demand. When you factor in the real risk of shutting down a line because parts have not arrived on time, there is a financial incentive to source onshore.



Where Does Off-Road Construction Equipment Manufacturing Go From Here?

As we move toward sustainability and affordability, off-road construction vehicles might start to look a bit different. What could this sector look like if it fully embraces electrification and uses it to improve its processes and output?



Compact vehicles will lead the way.

The pioneers of electrification in the off-road vehicle industry are likely to be more compact machines. These vehicles are nimble and can negotiate urban construction environments. They'll test the ground that electric power is easier to use and more affordable in the <u>lighter-duty vehicle</u> category. Plus, they will teach us lessons that can be applied to other use cases.



Sustainability legislation will dictate production methods.

Many government contracts mention sustainability, but legislation will require <u>carbon</u> <u>footprint accountability</u>. Therefore, planning for sustainability will be a top priority. It will guide how work is done with vendors, the products they choose to make, and the materials and processes used to make them. Local and regional governments will expect these vehicles to meet targets for lowering all forms of pollution. This will challenge the manufacturing ecosystem to imagine and implement new solutions for exhaust, noise, and particulates.



Going green will be incentivized.

Some places are already using incentives to encourage the move to electrification. California is on the verge of introducing a <u>voucher program</u> for off-road cargo and freight vehicles. The intent? To accelerate the development of vehicles that are both commercially viable and environmentally friendly. Get ready for more ways to motivate green growth in your slice of the off-road construction vehicle industry.



The industry is in a period of evolution. As players vie to develop better electrification methods, buyers will anxiously wait to see standardized processes. A method or fuel type that may work well for compact electric off-road vehicles may not be universal. Vehicles like <u>long-haul dump trucks</u> that have to make longer treks from source to dumping sites may need more development to extend battery life or figure out cable-connected equipment.

The near future will see a lot of change as users, manufacturers, and suppliers grapple with the demands of the environment and the economy. Forward-looking manufacturers will find a way to build a sustainable identity in the marketplace.





How to Maintain the Balance Between Economy and Environment

As a manufacturing decision maker, you have a lot on your shoulders. You want to embrace sustainability initiatives, but you have concerns about the instability and cost that new methods could bring. How can you push ahead while also minding your company's best interest?

Here are four strategies that will help you forge your path to sustainability and financial success:

\lambda 🛛 1. Lower risk however you can.

The risks of electrification and changing the status quo may seem large and looming sometimes. But there are multiple ways to lower risk until it is manageable.

For example, regionalizing your supply chain can slash transportation costs and delays and drastically lower your carbon footprint. Decrease your supply chain's complexity, and you can reduce time to market and your exposure to <u>disruptive variables</u>.

2. Optimize inventory.

Invest in a digital replenishment solution that brings more transparency to inventory usage and on-hand volumes. <u>Optimas' OptiTech Solutions</u> can help manufacturers automate orders and deliveries based on real-time data.

OptiTech can help lower the cost of goods sold, improve operating cash flow, and extract more accurate data that can lower excess and obsolete stock and boost efficiency. From a logistics and operations standpoint, you'll develop more clarity about your needs. In turn, this helps prevent shortages and stockouts and the aggravation they cause because you can forecast needs more confidently.





3. Enhance operations.

Every manufacturer is looking for new ways to improve efficiency, cut waste, and design parts and products that work better for customers and the environment. Undertaking operational enhancements means finding specific areas of your production line that could be better.

Ask yourself these questions to determine how you can make the process of fastening parts and components more efficient:

- How could fasteners perform better?
- Would consolidating several parts into one component be easier to handle for production teammates?
- Are the specs for torquing fasteners correct and easy to understand? Are the tools to tighten fasteners designed well for the production environment?
- Are there wasteful practices like SKU proliferation inside your facility? For instance, value analysis and value engineering activities aid both the manufacturer and the environment by reducing raw materials production, transportation, and the resources required to manage the inventory.



4. Improve quality.

Optimas uses advanced product quality planning, root cause analysis, and failure mode and effects analysis to effectively diagnose, correct, and mitigate product risk from development through sunset. In-house, ISO 17925-compliant quality labs in the U.S. and U.K. offer world-class testing capabilities to complement Optimas' zero-defect processes and culture.

Along this journey, we use the technologies in our tool stack to find every opportunity to improve quality. We aim to reduce the resources required — both natural and economic — to mitigate product development missteps, assembly problems, and post-sale recalls and failures.

Construction vehicle manufacturers have a long history of trying to balance their impact on the environment and their pursuit of profitability. As the business and natural worlds change, expectations are growing to create more sustainable practices. So are the resources to make this convergence happen.

If you'd like to learn more about what Optimas has to offer, please <u>let us</u> <u>know</u>. Our team is more than happy to discuss your business needs and find a solution that's right for you.

