

VANGUARD™

THE OEM'S GUIDE TO

ELECTRIC EQUIPMENT DESIGN



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NEED HELP CHOOSING A PATH?

Discover which electrification design path — simple design or more tech-forward — is best for your equipment and for your customers

LEARN MORE ►



UNLOCK NEW POSSIBILITIES WITH ELECTRIC

Through a comprehensive examination of industry trends and the ongoing shift toward greener practices, we've gained valuable expertise helping companies like Norton Clipper make the successful transition to electric.

Now, we're ready to put that experience to work for you.

“

It's been a pleasure developing products with the Vanguard team. They're very professional, easy to work with, always available and answer questions very quickly. They make developing products that are battery powered easy and simple.

”

*Paul Edwards,
Product Manager / Product Engineer, Norton Clipper*



SHAPING THE FUTURE OF EQUIPMENT DESIGN

As companies like Norton Clipper have already discovered, our industry stands at a critical crossroads. Where companies were traditionally dominated by gas-powered machinery, we're now witnessing a profound transformation as more and more manufacturers pivot toward electric-powered alternatives in markets that demand it. You play a pivotal role in designing and producing electric equipment that meets these demands — and we're ready to help.

This guide is designed to empower you with the knowledge and insights you need to navigate this exciting evolution. It will also help you understand two primary paths you can take to design successful battery-powered equipment your customers will love.

But before we dive in, there are a few things to consider upfront depending on the markets you serve.



ELECTRIFICATION'S IMPACTS ACROSS KEY INDUSTRIES

The move to electric power is gaining momentum, driven by strong financial incentives and specific market demands. A deep dive into the total cost of ownership (TCO) of these machines reveals that electric equipment can deliver significant savings over a five-year period when compared to traditional combustion engines. These savings come primarily from less downtime and reduced maintenance needs.

What's more, battery costs are consistently decreasing, further strengthening the financial appeal of electric equipment. While the economic benefits are clear across the board, the primary reasons for adoption can differ quite a bit from one market to another. Let's take a closer look at three different segments.



CONSTRUCTION

The key drivers for electrification in construction are the need for indoor-use capabilities and improved jobsite safety. Electric equipment eliminates emissions, allowing for operation in enclosed or poorly ventilated spaces. The significant reduction in noise also leads to safer jobsites where crews can communicate more easily. An added benefit is that the reduced vibration and simpler “push-button” operation can lower worker fatigue and make training new employees faster, which helps address high turnover rates.



**Total energy measured using a 0.2C discharge per IEC 61960-3:2017*

**SWAPPABLE BATTERY SYSTEMS
POWERED BY BATTERIES LIKE
THE VANGUARD™**
48V
1.5kWh*
**COMMERCIAL BATTERY SHOW A
SAVINGS
OF MORE THAN
26%
IN CONSTRUCTION**



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ELECTRIC SYSTEMS VS. FUEL SYSTEMS

Below is a machine life cost comparison of electric versus engine for Somero concrete laser screeds.

ELECTRIC SYSTEM		ENGINE SYSTEM	
Motor X 3	\$950	\$1,100	Motor (engine)
Batteries X 3	\$9,500	\$70	Battery
Controllers X 3	\$370	\$100	Exhaust System
Charger X 3	\$650	\$1,580	Hydraulic System (pumps, valves, hoses, etc.)
Throttle	\$75	\$40	Throttle
UPFRONT COST	\$11,545	\$2,890	UPFRONT COST
Electric Bill	\$1,292	\$14,400	Fuel Cost
Maintenance	\$0	\$2,009	Maintenance
2,000-HOUR TCO	\$12,837	\$19,299	2,000-HOUR TCO



Electric machines tend to have a higher initial cost, but in the long term, they have a better return on investment. In this example, fuel costs can reach \$14,000 when powering a gas engine, while electricity is only around \$1,292. This offsets the upfront price difference and is what many end users and OEMs need to understand.



INDUSTRIAL

In the industrial sector (including applications like scissor lifts and autonomous machinery in manufacturing plants), electrification drivers are similar to construction but with added emphasis on maintenance and automation.

For equipment like scissor lifts, moving from lead-acid to lithium-ion batteries drastically reduces maintenance and downtime. Electrification is also a key enabler for autonomous equipment — while many of these applications have always been electric, better battery technology provides longer run times and quicker charging cycles, which improves safety and removes the need for an onboard operator.



> Swappable battery systems powered by batteries like the Vanguard™ 48V 1.5kWh* Commercial Battery show a **SAVINGS OF MORE THAN**

23%
IN THE INDUSTRIAL
SEGMENT



> Similar to construction, swappable battery systems powered by batteries like the Vanguard™ 48V 1.5kWh* Commercial Battery show a

SAVINGS OF MORE THAN

26%
IN COMMERCIAL
TURF CARE

due to fuel savings and reduced maintenance and downtime.



COMMERCIAL TURF CARE

For commercial turf, a primary driver of electrification is the increase in municipal requirements for quieter, low-emission equipment. While the large mower battery market is still emerging, there has been significant growth in other turf applications like turf rakes and seeders. For rental yards, the lower maintenance of electric equipment is a major advantage for tools that are used periodically or even rented back-to-back. The use of a swappable battery system further simplifies operations, as one battery can be used across multiple pieces of equipment. An added benefit is the elimination of fumes for operators, making the jobsite more pleasant and safer.

*Total energy measured using a 0.2C discharge per IEC 61960-3:2017



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CHOOSING YOUR ELECTRIFICATION DESIGN PATH

Electrifying equipment presents you with a new canvas — an opportunity to rethink old problems and design with your customer's core needs in mind. This journey boils down to a fundamental choice: to equip users with all the bells and whistles, or to provide a more basic, intuitive experience similar to gas-powered equipment.

From an engineering perspective, you'll build from a core set of electric components — but from a product management and marketing standpoint, it's best to think of this as two distinct paths to meet your customers' exact needs.



TECH-FORWARD DESIGN APPROACH

Similar to targeting car buyers seeking premium features, this design approach offers customers the full “feast” of electrification, creating a smart machine with advanced controls and data. Choose this path if your customers demand operational insights and are prepared to pay a premium for solutions to challenges like labor shortages or predictive maintenance.

[GO TO THE TECH-FORWARD DESIGN PATH ►](#)



SIMPLE DESIGN APPROACH

This approach caters to end users who just want their equipment to turn on, run as planned and turn off, making the transition from gas to electric seamless and intuitive. This path prioritizes simplicity with familiar controls, making it ideal for compact equipment or as a low-risk starting point to quickly get products into customers' hands and gather feedback.

[GO TO THE SIMPLE DESIGN PATH ►](#)

OR

NEED HELP DECIDING? Take our electrification design path quiz and find out fast.

[TAKE THE QUIZ ►](#)



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SO WHICH ELECTRIFICATION PATH IS RIGHT FOR YOU?

We'll help you decide. Just answer these simple questions to determine which design path is likely the best fit for your next electrification project.

	YES	NO
Do you already have electric equipment in your fleet?	2 POINTS	1 POINT
Do you have good margins that would allow you to incorporate more advanced features?	2 POINTS	1 POINT
Do your customers want ongoing operational data and insights from their equipment?	2 POINTS	1 POINT
Can you charge a premium for the value you'd be creating with more advanced features and "bells and whistles"?	2 POINTS	1 POINT
Is your primary goal for this project to get a product into customers' hands quickly to gather feedback?	1 POINT	2 POINTS
Are you looking for a lower upfront investment and a reduced risk profile for your initial electric product?	1 POINT	2 POINTS
TOTAL =		

8 POINTS OR MORE

Your ideal path is likely a



TECH-FORWARD
DESIGN APPROACH

GO TO THE TECH-FORWARD DESIGN PATH ►

7 POINTS OR FEWER

Your ideal path is likely a



SIMPLE
DESIGN APPROACH

GO TO THE SIMPLE DESIGN PATH ►





TECH-FORWARD DESIGN APPROACH

THE TECH-FORWARD DESIGN ADVANTAGE

Opting for the tech-forward path means leveraging data and connectivity to unlock new value for your end users. This path requires a deeper investment in R&D but can result in a highly differentiated product that commands a premium price.



KEY DESIGN PRINCIPLES

The core characteristics of a tech-forward design include features enabled by data and intelligent controls. This means integrating elements like:



**LARGE DISPLAY
SCREENS**



**ADVANCED USER
INTERFACES**



**INTELLIGENT CONTROLS,
SUCH AS TRACTION CONTROL**



ECO-MODES



LOAD MONITORING

The principle is to use the data flowing on the CANbus from the battery and motor controller to solve customer problems. For example, you can “gamify” operations to teach users how to be more efficient or enable predictive maintenance alerts. This data also allows you to better understand the equipment’s load and refine your product over time based on customer needs.





TECH-FORWARD DESIGN APPROACH

R&D FOR TECH-FORWARD ELECTRIC EQUIPMENT

The R&D process starts with deeply understanding your customer and identifying which new features — unlocked by technology — can solve their biggest on-site problems. Because these builds are more complex, the process can involve significant software development to interpret signals from the system's components (battery, motor controller, vehicle control unit, etc.) and translate them into a valuable user feature. You'll work closely with our engineering team to understand what data is available and how to incorporate it into algorithms for features like traction control or autonomous operation.

This new technology offers you an opportunity to rethink problems and approach equipment design with creativity. Instead of simply swapping out an engine, you can explore new mechanical approaches that are more energy-efficient or leverage increased data and monitoring to send information to an app or cloud for enhanced fleet management. This is about enabling new possibilities and finding true innovation that benefits your customers.



TECH-FORWARD DESIGN BENEFITS

Enhanced Performance and Precision: Leveraging intelligent controls like traction control, tech-forward designs allow you to optimize equipment performance, which leads to more efficient and precise operation in demanding applications.



ACTIONABLE BUSINESS INTELLIGENCE:

Beyond basic operation, these systems provide valuable data and insights into real-world usage, enabling advanced fleet management, predictive maintenance and tailored solutions for customer pain points.



STRONG COMPETITIVE DIFFERENTIATION:

By offering advanced features and highly specialized capabilities, you can create a unique market offering that elevates your brand and is difficult for competitors to easily replicate.



UNLOCKING NEW APPLICATIONS:

Technology-forward designs open the door to entirely new equipment functionalities and market segments previously unattainable with traditional or simpler electric systems.

TECH-FORWARD DESIGN R&D PROCESS

CUSTOMER PROBLEM IDENTIFICATION

SOFTWARE DEVELOPMENT

FEATURE INTEGRATION





TECH-FORWARD DESIGN APPROACH

CONSIDERATIONS FOR TECH-FORWARD DESIGNS

The biggest potential drawback is the risk of creating a product that's too costly or complex for your market. You must have a solid business case for every added feature to ensure that customers will see the value and pay for it.

Technical challenges include designing more complex wire harnesses for data and control signals, managing weight distribution, and significant software development. It's crucial to understand that while an electric system enables new possibilities, not all ideas will work out well. The focus should be on the 10% of ideas that will have the most lasting impact for your and your customers' bottom lines.

COST

The upfront investment in R&D and components is higher for this path. However, a successful tech-forward product can be priced at a premium, creating a highly valuable and defensible position in the market that's harder for competitors to copy.





TECH-FORWARD DESIGN APPROACH

PERFORMANCE COMPARISON: VANGUARD™ LITHIUM¹ VS. THE HONDA EGX²

When considering advanced electric systems, performance matters. Here's how Vanguard Lithium compares to a top competitor on a 24-inch concrete finishing trowel:

		RUN TIME <i>Continuous</i>	CHARGE TIME <i>100%</i>	MACHINE PERFORMANCE	WEIGHT	SWAPPABLE
 VANGUARD 48V 1.5KWH BATTERY		91 MINUTES	75 MINUTES³	100M² OF FRESH CONCRETE⁴	45 LBS⁵	YES
 HONDA EGX		40 MINUTES	90 MINUTES	48M² OF FRESH CONCRETE	55 LBS⁶	NO

This comparison demonstrates how Vanguard's battery technology can offer superior runtime, faster charging, lighter weight and the crucial advantage of swappable batteries, directly addressing customer concerns around downtime and productivity.

¹The performance data for Vanguard products referenced in this material was obtained through internal testing conducted by Briggs & Stratton LLC.

²The performance data for the Honda EGX referenced in this material was obtained from a third-party source in January 2024.

³The Vanguard 1.5kWh battery can be charged in 75 minutes with the Vanguard 1425W charger when the battery temperature is < 30° C at the start of charging.

⁴Performance metrics for the 1.5kWh battery are based on controlled testing conditions and indicate the capability to cover approximately 100M² of fresh concrete in four passes.

⁵The stated weight of 45 pounds for the Vanguard battery pack, motor and motor controller is based on manufacturer-provided specifications.

⁶The stated weight of 55 pounds for the Honda EGX, motor and motor controller is based on available specifications.

Reference: <https://engines.honda.com/models/model-detail/gxe2h#Features>

Reference: www.flextool.com.au/products/soil-compaction/all/honda-egx-battery-and-charger





SIMPLE DESIGN APPROACH

THE SIMPLE DESIGN ADVANTAGE

The simple design path is about delivering the core benefits of electrification — reliability, low maintenance, zero emissions and so on — in a straightforward, cost-effective package. This is often the fastest and lowest-risk path to market.



KEY DESIGN PRINCIPLES

Simplicity is the guiding principle here. The system consists of essential components like these:



BATTERY

With its integrated battery management system or BMS



MOTOR



SIMPLE THROTTLE OR ON/OFF SWITCH



MOTOR CONTROLLER

The goal is to replicate the familiar, intuitive operation of gas-powered equipment. Many prototypes are as simple as a switch that tells the motor controller to spin at a fixed RPM. The design focuses on robust, get-the-job-done functionality over nonessential features.





SIMPLE DESIGN APPROACH

R&D FOR SIMPLE ELECTRIC EQUIPMENT

This path offers a much faster development time. A common approach is to take an existing gas-powered product and work with our engineering team to prototype an electric version. This allows you to quickly get a working model into the field to gather real-world data on load, duty cycle and energy requirements — information that 95% of OEMs switching from gas don't have. This data is then used to refine the final product.

This path lowers the upfront investment and risk profile, making it an easier decision for leadership teams. Getting a product to market quickly means you learn how people are using it, informing your future decisions on adding more advanced features.



SIMPLE DESIGN BENEFITS



FASTER SPEED TO MARKET:

It allows for quicker entry into the electrification space, gaining customer feedback and learning valuable lessons.



EASIER TROUBLESHOOTING:

Simpler systems are easier to understand and troubleshoot if anything goes wrong.



INTUITIVE OPERATION:

Operators can learn to use the equipment much faster, as it often mirrors familiar gas-powered controls.

SIMPLE DESIGN TIMELINE

RAPID PROTOTYPING

FIELD DATA COLLECTION

QUICK MARKET ENTRY



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SIMPLE DESIGN APPROACH

CONSIDERATIONS FOR SIMPLE DESIGNS

The main drawback of the simple approach is that the final product may be less flashy and more easily commoditized by competitors. It may lack the “wow” factor of a tech-forward design and offer a less refined user experience if not well-tuned. It’s also critical to ensure that the simple design doesn’t just swap a motor for an engine without redesigning the equipment, as designing ground-up around electric components often yields a better product.

COST

The lower cost and faster speed to market allow you to enter the electrification space, gain customer feedback and learn valuable lessons that can inform future, more advanced models. This approach involves less upfront investment, making it a more accessible choice for your business.

The Briggs & Stratton Power Application Center created the initial electric plate compactor prototypes, which Bartell is now customizing and using as a platform to electrify additional products in their portfolio.



3 REASONS TO COLLABORATE FOR ELECTRIFICATION SUCCESS

Regardless of which design path you choose, success in electrification hinges on a close partnership with the right battery supplier. Your supplier should be more than a component vendor — they should be a system integrator and a partner throughout the entire product lifecycle. At Vanguard, we make this a top priority.

Here are three key reasons why partnering with Vanguard can provide a better path forward for your electrification projects:



1

APPLICATION EXPERTISE AND INTEGRATION SUPPORT



A key challenge for OEMs — especially small to mid-size companies — can be the lack of in-house know-how for electrification. We provide critical assistance, helping with everything from mechanical placement and weight distribution to complex wire routing and software integration. Our team acts as an extension of your engineering team, helping you understand how to use the available data and solve problems. When you select Vanguard, you get much more than just a battery pack — you get a true partner.

To ensure a successful collaboration, you should be prepared to share key information with us upfront, including expected duty cycle, energy needs and size constraints. Starting your design process with our considerations in mind from the very beginning can lead to a superior product.



2

RELIABILITY AND CONSISTENCY



You need a reputable partner that delivers a safe, reliable and consistent product. A major benefit of partnering with an established supplier like Vanguard is product stability. Our battery's form factor won't suddenly change, forcing a costly redesign of your equipment — a common issue with other battery manufacturers. This allows you to design with confidence, knowing the components you rely on will be available and consistent in the future.

Even as the technology inside the battery improves, we'll improve it, but we won't take away the option from you. You'll still be able to get the same or better performance without having to redesign your machine every year because we change something.

3

FULL LIFECYCLE PARTNERSHIP



A true partner is there from the initial idea to the end of the product's life. This includes providing global service and support after the launch and helping manage the battery at its end-of-life by facilitating recycling. This comprehensive support, including responsive communication with a team readily available during your business hours, is a critical factor that many OEMs overlook when selecting a supplier. We're not just trying to get the sale — we're committed to making your application successful.



HOW TO OVERCOME CUSTOMER SKEPTICISM AND ESTABLISH TRUST

The transition to electrification presents a significant opportunity, but it's not without questions and valid concerns from customers accustomed to combustion-powered equipment. Key risks for potential buyers include high upfront costs, resistance to adopting new processes within their teams and concerns over the stability of a new supply chain.

Successfully overcoming this skepticism requires a strategy built on data, transparency and trust. To counter high upfront costs, for example, you can provide clear evidence of long-term TCO benefits while offering practical solutions like volume discounts and bundled infrastructure support to ease the initial investment.

As you consider electrification, it's natural to have concerns — so let's address some of the common misconceptions head-on.



MYTH:

“Electric” means less power, poor reliability and an inability to handle a full workday.

PRODUCT PERFORMANCE AND RELIABILITY

REALITY:

Modern electric powertrains are engineered for high-torque, heavy-duty applications. The conversation now shifts from horsepower to jobsite effectiveness.



PRO TIP:



Demonstrate performance through pilot programs, hands-on demos and case studies to build confidence. A swappable battery allows hot swapping in under two minutes, eliminating refueling downtime.





MYTH:

Batteries are fragile and won't withstand harsh jobsite environments

DURABILITY AND LONGEVITY

REALITY:

Design for the environment with rugged, IP-rated packs for "rental-grade" durability.



PRO TIP:



Transparency is key. These batteries are rated for a specific life cycle (e.g., 1,000 cycles) and provide a predictable maintenance schedule — a significant advantage over unexpected combustion engine failures.



MYTH:

Upfront electric equipment costs are too high.

COST CONSIDERATIONS

REALITY:

Focus on the payback period. Analysis shows a breakeven point can be achieved in a 2- to 2.5-year window, a compelling proposition for the rental market. This rapid ROI is driven by massive savings in fuel, maintenance and downtime.



PRO TIP:



Use pilot data and interactive TCO calculators to validate projections and build confidence.





MYTH:

Lithium-ion batteries pose fire risks (thermal runaway) and require complex handling.

SAFETY



REALITY:

Electrification eliminates flammable fuels and hazardous CO/NOx fumes, offering inherent safety advantages. Battery safety features like battery management systems (BMS) and rigorous safety certifications (e.g., UL standards) are built in.



PRO TIP:

Provide comprehensive training.



MYTH:

My crew will have to wait 4 to 8 hours for a machine to charge.

CHARGING AND RUN TIME



REALITY:

Reframe the conversation to “continuous uptime.”



PRO TIP:

A swappable battery platform eliminates charging downtime altogether — an operator can swap a battery in under two minutes. With DC fast chargers, batteries can often be charged over lunch or during a break. And on sites without power, a crew can bring a crate of charged batteries, creating a flexible “shared energy pool.”



THE VANGUARD ADVANTAGE

In a rapidly evolving market, choosing the right power partner is the most critical decision you'll make. Vanguard provides more than a battery — we provide a complete system and a partnership built around your success.

A COMPLETE, INTEGRATED SYSTEM

We offer a full system solution, including the battery with an integrated BMS, motor and controller. This simplifies the design process for you and ensures that all components work together seamlessly. This one-stop shop approach alleviates much of the work involved in electrifying equipment.

UNMATCHED APPLICATION SUPPORT

Our team of engineers works as an extension of yours, providing hands-on assistance from initial concept to final production. We help you navigate the complexities of electrification so you get to market faster with a better, more reliable product. We're there to help you understand the signals from the system and how to incorporate them into features. We also offer global service and support, a crucial factor not many competitors can match.

DESIGNED FOR YOUR CUSTOMERS

With both simple, rugged designs and the capability for highly technical, feature-rich applications, we provide the flexibility to build the exact product your customers want. Our comprehensive lineup of commercial lithium-ion battery packs — available in both fixed and swappable configurations — features a range of power options to address the biggest customer concerns around downtime, giving you a clear competitive advantage. Plus, we're committed to consistency. Our battery form factor won't change, protecting your designs and investments for the long term.



PARTNER WITH VANGUARD

The time for electrifying more equipment is now. The data confirms the economic benefits, and the market is moving quickly — companies that get ahead of the curve will secure a lasting advantage. The question is no longer if you should electrify, but how. Whether you choose a simple, intuitive design or a tech-forward approach, the path to success is easier than ever.

At Vanguard, we're dedicated to guiding you through this process. Our comprehensive solutions, combined with our deep application expertise and unwavering support, empower you to overcome challenges and achieve your electrification goals.



Ready to learn more?

Contact us today if you've been thinking about making the switch to electric. Our team is ready to guide you through the process and help you understand which path is best for you and your customers.

[Get in touch to learn more.](#)

VANGUARD™

vanguardpower.com



*Total energy measured using a 0.2C discharge per IEC 61960-3:2017
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