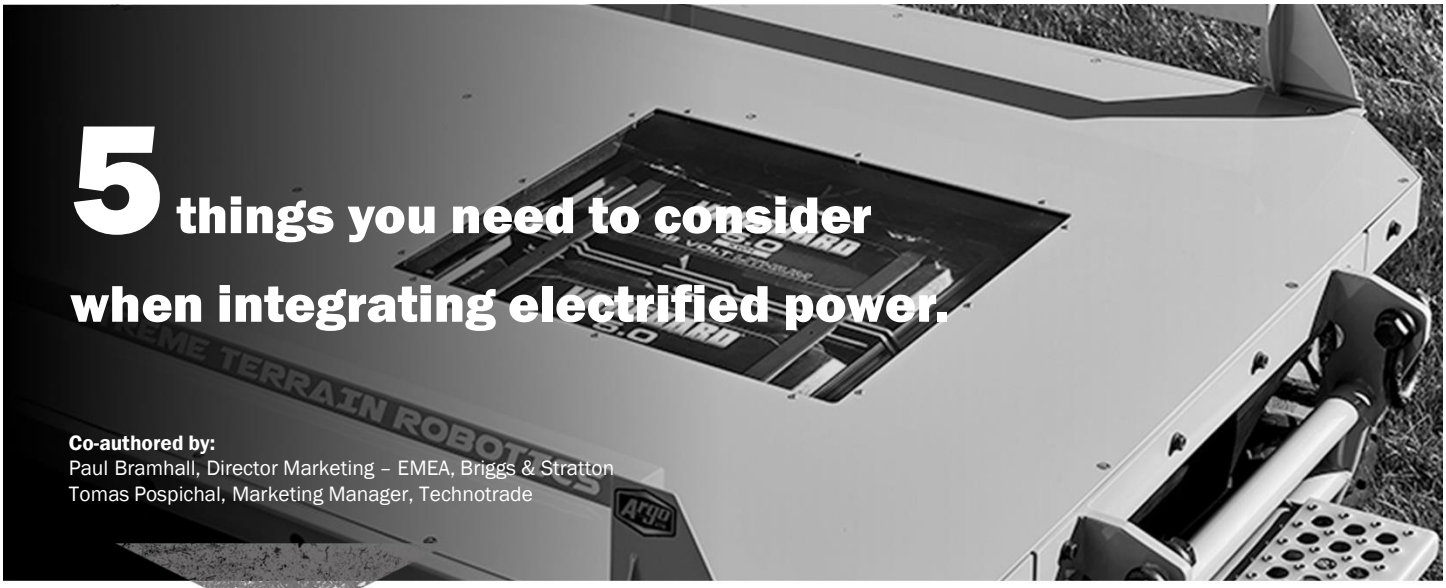

# 5 things you need to consider when integrating electrified power.

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**The electrification of commercial grade machinery is one of the biggest talking points for OEMs today. Lead acid or lithium-ion? Design and manufacture in-house or collaborate with an electrification partner? These are fundamentally the most important decisions you will need to make at the beginning of your electrification journey.**


Traditionally, most OEMs source petrol or diesel engines from specialized engine manufacturers and rarely produce them in-house. This is in part due to the complexity of design and manufacturing processes required. But it's also because of the capital investment and technical know-how needed to achieve best performance – and all while maintaining durability and adhering to stringent global emission regulations.

When it comes to batteries, sourcing cells and components off the shelf to manufacture your own system seems easier and less capital intensive than with traditional engines – providing an alternative path to gain flexibility, increased customization and ultimately save costs. However, producing and integrating electrification effectively into machinery can be full of potential pitfalls...

So, here are the key factors you should consider to successfully integrate electrified power:

## 1. Gauge market expectations

While everyone talks about finding greener alternative power solutions, whether that's battery, hydrogen fuel cells, or otherwise, remember that the market has established performance and cost expectations – and failure to align with these will result in costly consequences.

Developing new technologies is capital intensive and time consuming. Market adoption also takes time and therefore requires a long-term investment to realize the true ROI. Even then, some market segments will question technology performance, for example with battery, which is viewed by some as 'DIY' grade when compared to traditional internal combustion engine power and performance.

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Therefore, selecting the correct technology, delivering the right performance, and hitting the most appropriate market price points will determine the success of your electrification strategy.

## Factors to consider:

**Before embarking on your electrification project, you should consider the following: charge times, daily usage (hours used), life expectancy, load conditions, peak power draw, cooling requirements, operating temperatures, work environment, weight and price.**

## 2. Understand real-life application usage

The knowledge and experience of your in-house team is critical to ensure the successful integration of an electrified power solution into your equipment. Most off-the-shelf batteries and controllers have been developed for a broad range of applications and may not be equipped with the specific features, safety and protection devices your application requires.

Durability is extremely important for both the components and the system – including the motor, inverter, battery, controllers, etc. Your components therefore need to be high-grade and incorporate ingress protection (IP), which is critical should your equipment be exposed to dusty or wet environments. Just be sure to remember that IP is not a standard feature on most components, and IP ratings differ based on their intended usage.

Further factors to consider are vibration and temperature, which also have a significant impact on battery and component performance. It is crucial that you consider these before sourcing components as failure to get this right can lead to costly premature component failure.


## Our recommendations:

**Ensure your team fully understands real-life usage conditions – not just internal testing criteria – in order to qualify a product. Make a comprehensive list of all critical parameters, including but not limited to, power peaks, heat (temperature), current draw, cooling requirements, daily hour usage, user life expectations and load response. Also work with a technology partner that can offer the knowledge and expertise required to achieve the right mix of components to optimize integration. This will streamline the process and help you to maximize performance and longevity, while avoiding costly errors in applying the power source.**

## 3. Obtain the right know-how

Every application has its own unique performance characteristics and power draw requirements, which will require a level of personalized engineering and development to achieve the best results. Likewise, most off-the-shell batteries, battery components and controllers are designed to provide a generic set of performance characteristics that have not been designed around the very specific needs of your application.

Sourcing different components, for example cells and battery management systems (BMS), from different suppliers can also create challenges related to firmware incompatibility or the inability to communicate

between components. Furthermore, battery and component suppliers may have very little experience in applying power to your specific machine and probably do not understand the operating conditions in which it is subjected to on a daily basis. Therefore, any upfront cost savings you may achieve could end up being lost towards extended development and engineering timelines – or warranty claims that could have been avoided.

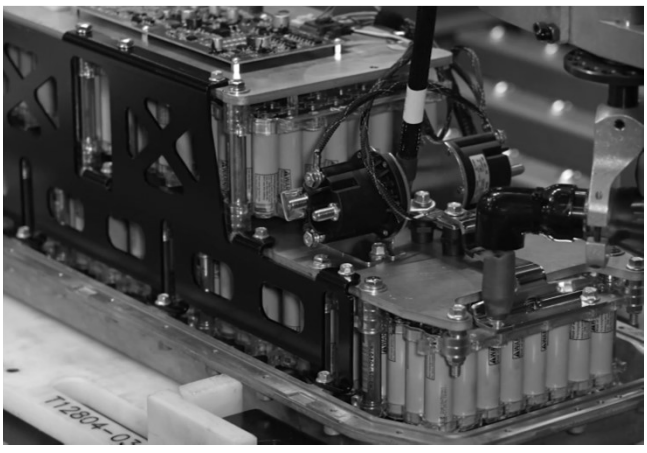
It is extremely important that you have the know-how to achieve the right power balance across EM, inverter, battery and accessories. This will determine how the machine operates, how much power it delivers, and if the power is applied correctly during the duty cycle. Even simple machines have several microcontrollers (inverter, BMS, master controller, display, HMIs, etc.), which is very different to the ones powered by internal combustion engines and hydraulic solutions.

In addition, all of these parts come from different suppliers, which means you need the expertise and experience to integrate them precisely and efficiently. The OEMs who have limited CAN-bus and programming competencies often underestimate this challenge and struggle to realize the true efficiency gains of electrified systems.

**Our advice:**

**Work with an established and experienced technology partner who can bring vast electrification and application engineering expertise to the table. While this may incur additional upfront costs, they can streamline the electrification process and save you time and money in the long run. The product integration and skillset a technology partner brings will fast track your development and remove numerous pain points during the integration and testing phases, ensuring you deliver an optimized electrified product to market.**

## 4. Access to new technology



Gaining access to the latest battery components, a challenge for most OEMs who choose to assemble in-house. Firstly, the latest battery technology comes at a premium price. Secondly, market-leading cell manufacturers require significant volume commitments from the OEMs and typically only ship in container quantities.

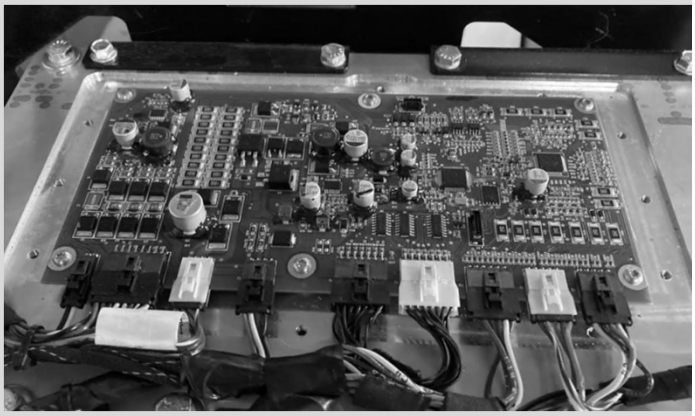
If an OEM does not fulfil these criteria, they will have to source cells and components from smaller, lesser-

know suppliers who do not necessarily have the most advanced technology and cannot guarantee the same level of performance quality.

**Our suggestions:**

**Identify a strong partner who has access to the latest technology from Tier 1 and 2 suppliers. Their economies of scale will give you access to industry-leading technology at a more affordable price point. Higher grade components will also ensure consistency across a large volume, and your technology partner will have undertaken all of the critical performance testing to ensure the optimized power solution. They will offer you the flexibility to order and ship in smaller, more affordable quantities too.**

## 5. Understand safety requirements



Monitoring battery performance at all times is crucial. Failure to do so can result in expensive failures and potential safety concerns. Unlike lead acid batteries, lithium-ion batteries are equipped with BMS, which is essentially the brains of the battery. The BMS monitors the temperature to ensure the battery stays within a safe operating range, it provides data on power utilizations and voltage, and it allows integration with both the machine and Internet of Things (IoT) devices.

However, while keeping tabs on the temperature of the battery may sound simple, the BMS is much more than just a thermometer. To ensure the battery stays within its operating range, the BMS is constantly monitoring and measuring not only the temperature but also the charge and discharge currents – as well as the voltages of each individual cell bank.

Since the primary safety concern with improperly managed lithium-ion batteries is a thermal runaway event, the BMS is therefore a critical component. If a lithium-ion battery exceeds its maximum allowable temperature range, it can go into a thermal runaway event – the temperature rises rapidly, releasing the battery's energy and eventually creating a fire. This will only happen when the battery isn't properly managed or protected with a BMS.

**Bottom line:**

**Lithium-Ion, with the proper system management, is safer, longer-lasting and more powerful than lead-acid. But it is extremely important that your team understands all the safety requirements. Technology partners have this know-how and can ensure you address these critical safety measures in the very early stages of development – ultimately fast-tracking your program and safeguarding you against potential hurdles and costs at a later date.**

**If you are currently planning a machine electrification project, the technology experts at Vanguard Commercial Power and Technotrade will be happy to discuss your concept or provide you with a system solution offer.**

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