DRIVING PERFORMANCE, DELIVERING RESULTS

See how Vanguard delivered on performance, flexibility and adaptability to power the next generation of Club Car® Tempo® and Onward® vehicles.

Club Car — a leader in golf cars and commercial utility vehicles — needed a high-performance, reliable power source for its latest generation of electric golf cars. So, the company turned to a familiar source for lithium-ion battery solutions to power the Tempo and Onward products: Vanguard. Since **2020**, Vanguard has not only supplied premium battery packs to Club Car but has also been a trusted partner in the design integration process. **Vanguard's comprehensive line of lithium-ion batteries** have proven to be the ideal solution for these industry-leading vehicles.

This **history of successful collaboration** laid the groundwork for the ambitious project that would bring the next generation of Club Car vehicles to life.

DEFINING THE REQUIREMENTS: PERFORMANCE WITHOUT COMPROMISE

Maintaining its industry leading performance and range was paramount to Club Car as the company looked to bring the Tempo and Onward cars to market. When selecting a battery solution for these new vehicles, Club Car wanted a power package that would enhance performance and efficiency, improve range and reduce vehicle weight without compromising durability. Seamless integration of the new battery system into their existing vehicle platforms was also critical to minimize design changes and streamline manufacturing processes.

Vanguard stepped up to the challenge, collaborating closely with Club Car's engineers to develop optimized lithium-ion battery packs tailored specifically to power the Tempo and Onward models. This close collaboration was essential to the project's success.

"We had to basically redo the design of the battery that we currently produce today, and in about an 11-month timeframe," said Justin Rice, Senior New Product Development Program Manager at Vanguard. "In four weeks, we got to a point where we had a basic footprint, the enclosure and the mounting locations determined."

> **Between their local manufacturing outside of Atlanta to their global testing capabilities to ensure flexibility of supply — Briggs & Stratton has supported the Club Car development and operations team every step of the way.**
>
> *David Hules*
> *Director of Product Management at Club Car*

3.8* KWH

TEMPO

4.0* KWH

ONWARD

THE CHALLENGE: A TIGHT TIMELINE FOR OPTIMIZED POWER

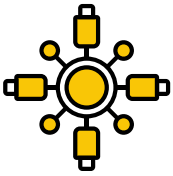
Club Car had an ambitious timeline and wanted to launch the new Tempo and Onward lines by April 2025. Vanguard was ready to work side by side with Club Car to meet the deadline.

Vanguard developed robust power packages featuring its newly optimized 3.8kWh* and 4.0kWh* battery packs. These packs provide the impressive performance Vanguard is known for in the off-highway electric equipment space and leverage the latest in cell technology. In addition to providing robust electric power options, the battery solution provider's proximity to Club Car's company headquarters was an added bonus.

"As we looked to develop a third generation of lithium-ion-powered golf cars, it was clear to us that Vanguard remained the right partner," said David Hules, Director of Product Management at Club Car. "Between their local manufacturing outside of Atlanta to their global testing capabilities to ensure flexibility of supply — Briggs & Stratton has supported the Club Car development and operations team every step of the way."

KEY BATTERY DESIGN & INTEGRATION: ENHANCED PERFORMANCE FOR CLUB CAR

Vanguard's latest battery innovations for Club Car's Tempo and Onward vehicles showcase a detailed design focused on seamless integration and improved performance. The optimized 3.8kWh* and 4.0kWh* batteries significantly boost vehicle range, allowing users to travel farther and for a longer amount of time on a single charge.



Simplified Mounting & Connections
The batteries feature custom-engineered mounting feet that directly align with Club Car's under-seat bucket. This eliminates the need for extra mounting parts, speeding up Club Car's assembly. In addition, top-mounted holes allow Club Car to directly install key components like the charger and vehicle control system onto the battery.

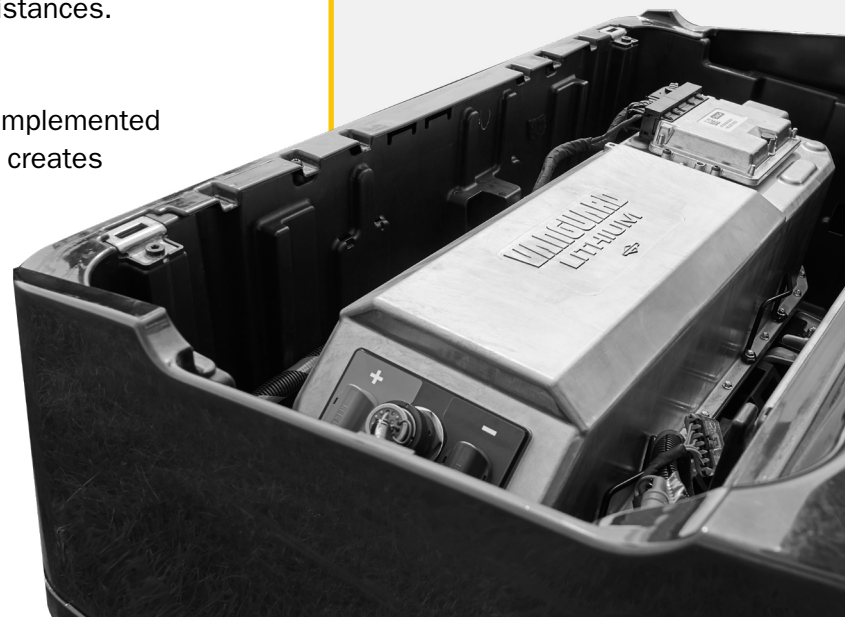
Improved Vehicle Performance & Safety
The redesign also focused on boosting vehicle performance, efficiency and safety. A key improvement is a significant reduction in weight, which enhances stability and rollover safety.

Higher Energy Density for Extended Range
These new batteries offer a higher energy density than previous models. This means more power in a lighter, more compact package, which is crucial for better overall vehicle performance and efficiency. Specifically, the optimized 3.8kWh* battery now achieves 0.14 kWh per liter, a significant jump from the previous 0.09 kWh per liter. Similarly, the 4.0kWh* battery has improved from 0.09 kWh per liter to 0.15 kWh per liter. These advancements mean the new, optimized packs can store significantly more energy in the same amount of space, delivering superior power without increasing battery size. Vanguard engineers optimal battery capacity to deliver consistent and reliable power for quicker acceleration and longer driving distances.

Enhanced Battery Longevity
To ensure long-term reliability, Vanguard implemented a new automatically applied gasket. This creates a more robust and consistent airtight seal, reducing the risk of leaks from environmental contaminants. Furthermore, Vanguard enhanced the battery's intelligence with an integrated battery management system that works with and controls Club Car's new auto park brake feature.

> We designed the module to effectively utilize the latest cell innovations. This strategic integration of the cell configuration within the module directly allows us to offer both the 3.8kWh and 4.0kWh options. This resulting flexibility, enabled by the underlying cell technology, is a significant advancement for the platform.

Justin Rice
Senior New Product Development Program Manager at Vanguard



RAPID DEVELOPMENT AND STRONG PARTNERSHIP: KEYS TO SUCCESS

Navigating normal manufacturing challenges to achieve an optimized product is a challenge in and of itself. But Vanguard and Club Car were also able to celebrate the meeting of that very tight deadline. From initial design concepts to full-scale production, the project was accomplished in an impressive timeframe of approximately 11 months. This accelerated timeline was only possible because both parties were committed to consistent and direct communication. This included daily design reviews that ensured seamless integration and a deep understanding of Club Car's specific requirements.

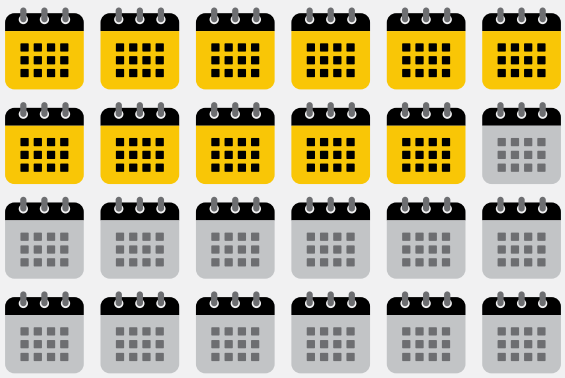
"Our collaboration was truly about two partners coming together, supporting the future of our relationship through the development of a battery pack that not only integrates seamlessly into their product but also helps them reduce costs and incorporate more competitive features," said Athan Tsokolas, Product Manager for Vanguard Lithium-Ion Batteries.

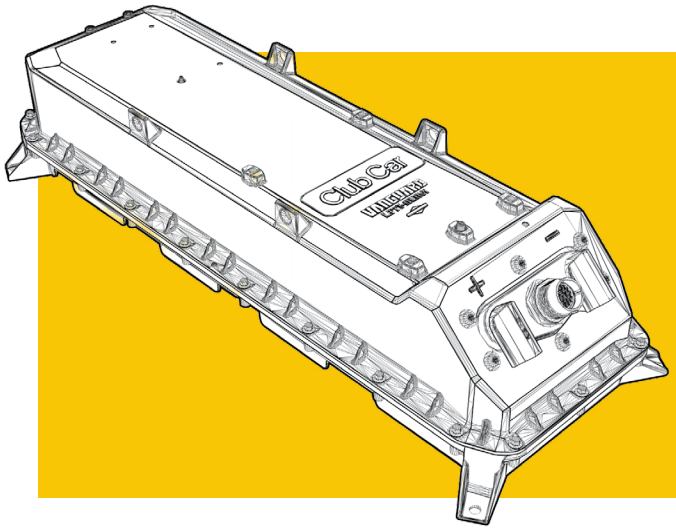
ADVANCED MANUFACTURING PROCESSES FOR QUALITY AND SCALE

Along with these advancements in battery design, Vanguard also implemented significant improvements across its manufacturing processes. When it adopted the automated gasket approach, Vanguard observed a higher degree of repeatability and reliability compared to previous manual methods. Quality control measures were further strengthened by providing comprehensive traceability for every bolt installed. To meet the anticipated high demand, Vanguard strategically rebalanced its production line and significantly increased output capacity. Finally, the implementation of rigorous leak testing procedures on the production line helped to ensure that the batteries meet the stringent IP67 protection standard that indicates a product is water- and dust-resistant.

CLUB CAR PROJECT TIMELINE

Vanguard completed its Club Car integration project in a fraction of the time typically required for an initiative of this scale. While such complex projects often demand a two-year development cycle, this accelerated completion sets a new benchmark, demonstrating Vanguard's exceptional agility and expertise in bringing innovative solutions to market.





- **U.S.-BASED DESIGN, ENGINEERING & ASSEMBLY**
- **IN-HOUSE DESIGN & TESTING**
- **DEEP EXPERTISE IN LITHIUM-ION TECHNOLOGY**
- **COLLABORATIVE APPROACH**

THE VANGUARD ADVANTAGE: A BLUEPRINT FOR OEM ELECTRIFICATION

The success of the Vanguard-Club Car partnership highlights Vanguard's ability to provide tailored electrification solutions that drive tangible results for OEMs. Vanguard distinguishes itself through U.S.-based design, engineering and assembly. In-house design and testing further deliver quality and reliability. These factors, combined with Vanguard's deep expertise in lithium-ion technology and a collaborative approach, make them an ideal partner for OEMs looking to electrify their products.

Have a challenging electrification project?
We're ready to tackle it.

Get in touch to learn more.

vanguardpower.com

VANGUARD™

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