Husqvarna Commercial Robotic Mowers for Golf Courses

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Introduction

New challenges require new solutions
Like any industry, greenkeeping is evolving. And with change comes new challenges. Many of these are the result of having to balance the needs and demands of the golf players and the authorities, while at the same time keeping costs down.

A case in point is the need to maintain the course at a level that satisfies club members and attracts visiting players. One proven way of doing this is to mow the grass more often to achieve consistent turf height, control weeds and encourage the turf density and quality that players enjoy. However, more frequent mowing takes additional resources in the form of more equipment and personnel. Resources that many clubs don't have access to.

More equipment also equals even more maintenance. And when Golf Monthly listed the "5 main challenges facing greenkeepers"[1], labour shortages were at the top of their list. The article cited "anti-social hours, low entry level pay and a lack of appreciation for the work" as the reasons why there isn't enough people coming into the industry. This issue of not having enough staff will probably remain for the foreseeable future, with as many as a third of staff looking to leave according to a recent study conducted in the UK.[2]

Other big talking points within the industry revolve around sustainability and new environmental regulations. Not only are fuel prices, regulations and public perception making energy-inefficient fossil-fuelled mowing equipment obsolete and expensive to run, the golf industry is also expected to do its part to contribute to the climate goals. In addition, many of the fungicides and insecticides that greenkeepers previously used to treat their courses, have now been banned for sustainability reasons, making turf maintenance more time-consuming and expensive. The environment itself is also changing, with increasing weather volatility and more occurrences of catastrophic events such as flooding and fires. This unpredictability interferes with mowing regimes and greenkeepers' efforts to constantly maintain high-quality playing conditions.

The above-mentioned topics call for new ways of thinking around turf care. Faced with new challenges, golf courses and their greenkeepers need to push beyond the current limits and look for new solutions. One such solution is the paradigm shift from heavy, high-powered, fossil-driven machinery requiring many operators handling the equipment, to lighter, battery-driven and more energy-efficient autonomous technology.

The aim of this white paper
This white paper focuses on battery-powered commercial robotic lawn mowers – and the implications this technology brings. The aim is to provide golf courses, head-greenkeepers and superintendents, as well as other organizations that manage large turf areas, insights into the pros and cons of "going autonomous".

The text is structured in four main parts. The first provides a short explanation of how commercial robotic mowers work. The second, and main part of the paper, looks at the benefits and some common misconceptions surrounding the technology and how it can help head-greenkeepers overcome today's challenges. The third section aims to provide concrete advice about what to think about when investing in a robotic mower while the fourth and final section touches on how the technology shift might impact future golf courses.

How do commercial robotic mowers work?

Robotic mowers were introduced to the market in 1995 by Husqvarna. This new mower concept, based on small, lightweight, razor-sharp pivoting blades, initially powered by solar panels, raised a lot of eyebrows. Since then, more companies have entered the market, and robotic mowers have made several technology leaps, enabling more types of green spaces to be managed autonomously.

To achieve autonomous operation, commercial robotic mowers employ a variety of reliable and proven technologies, including satellite navigation, ultrasonic sensors as well as Bluetooth® and cellular communications. They come in a wide range of sizes and can even sometimes work together as a fleet to maintain different areas of the golf course.

Smaller robotic mowers normally require installation of guide and boundary wires to enable the robot to navigate and locate its base station. The mower works in irregular patterns inside the work area while cutting to create an even turf. When it needs to charge its batteries, it returns to its base (charging) station. When recharged, it continues mowing.

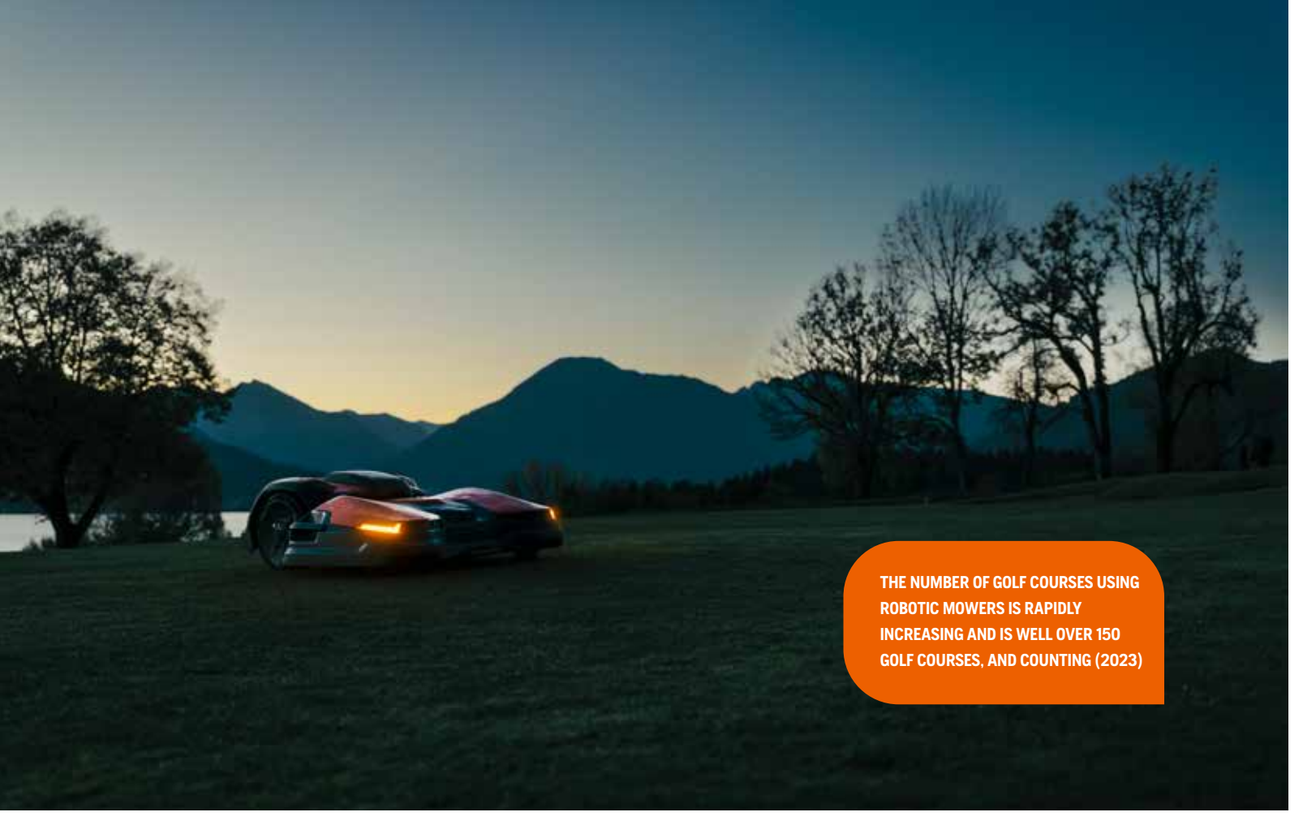
A new segment of robotic mowers don't need wires. Instead, they use a technique called RTK-GNSS which enhances the precision of satellite position data. This technology helps the mower to understand its location down to less than a centimetre and allows it to work within so called virtual boundaries.

Some models also have the ability to auto-adjust the cutting height for the specific work area, making them perfect for fairways, semi roughs and roughs as well as for surrounding areas and complex and steep sections that are difficult and challenging to maintain with a ride-on mower.

Most commercial robotic mowers are controlled using digital tools that allow the operator to manage a fleet of mowers without actually being present at the golf course. In the theory, the work can be performed from anywhere. Using a smartphone, tablet or laptop the operator can send start, stop and other commands or check and adjust settings and cutting heights, define work areas and stay-out zones etc. The digital tools alert the operator of any possible issues, such as an unexpected standstill, and can often track a mower's position in case of theft. In addition, the connected machines provide daily performance data that can be used to make fleet usage more efficient and productive. They also keep track of when service is needed and send reminders based on calendar time, making it easier to plan and carry out maintenance.

"THE USE OF ROBOTS HAS REALLY HELPED US. MY GREENKEEPERS CAN DO OTHER JOBS. INSTEAD OF MOWING GRASS, THEY CAN MAINTAIN THE BUNKERS, TAKE CARE OF THE SURROUNDINGS AND MAKE GENERAL IMPROVEMENTS EVERY DAY."

ERIK GRIPENBERG, COURSE MANAGER, ÖSTERÅKER GOLF CLUB, SWEDEN



THE NUMBER OF GOLF COURSES USING ROBOTIC MOWERS IS RAPIDLY INCREASING AND IS WELL OVER 150 GOLF COURSES, AND COUNTING (2023)

The benefits of battery-driven, autonomous mowers

Commercial robotic lawn mowers represent a major shift in the way golf courses are maintained as they offer a possible way of solving the seemingly impossible equation of having to do more work, but with fewer resources. At the same time, they provide a proven commercial solution which is currently in use at forward-thinking golf courses all over the world. Below are some of the most prominent benefits of going autonomous.

Improved turf quality

With lighter robotic mowers, the turf maintenance doesn't need to pause. The grass will always be and look freshly cut at consistent turf height as the robotic mowers maintain the turf day and night – even if it rains. This is a key factor in giving players a well-managed course. Greenkeepers can even bring back the tradition of a first and second cut of the rough, without any additional workload. The small pivoting blades on the robotic mower's cutting disk generates small clippings. These small clippings naturally fertilize the turf, which can make the grass grow better and stronger. A research group at the PISA University, found that "If you mow frequently, you remove less of the leaves each time. This reduces stress for the plant, and it becomes healthier." [3] The research group also found that "inside the clippings, there are elements that can come back to the plant after mineralization and uptake from the roots, providing an ecological advantage". In addition, the Nordic ROBOGOLF Science Study[4] saw less diseases with robots as the higher frequency of mowing reduces dew, which in turn helps reduce diseases in the grass.

Reduced labour costs

Labour costs often make up 60–70% of the total costs of lawn maintenance[5]. By replacing conventional mowers with commercial robotic mowers, costs can be reduced by approximately 50%[6]. With less need to operate ride-on and walk-behind mowers, greenkeepers can free up time for other activities, like levelling up the quality of surrounding details. Autonomous mowers also open the possibility of mowing at night (in countries where this is allowed). This practice is appreciated by golfers since it doesn't affect the game and frees up additional playing time – without any additional costs.

Increased reliability and peace of mind

Robotic mowers have been around for more than 25 years and have proven to be very reliable in a wide variety of conditions. They handle turf maintenance autonomously, cutting grass on a predetermined schedule and returning to the charging station as needed. For head-greenkeepers, this means less time spent on dealing with staff call outs. And thanks to digital services, managing a robotic fleet is a more efficient process than ever before.

Lower energy use

Autonomous mowers using cutting discs equipped with small pivoting blades (weighing less then 5 grams each) require very little power to operate. As a consequence, robotic mowers need only a fraction of the energy used for conventional mowers. Research indicates that battery-powered mowers can mow up to seven times longer than conventional gasoline-powered walk-behind rotary mowers equipped for mulching, with an energy consumption which is one-third that of gasoline-powered mowers[7]. An LCA analysis[8] conducted by Ramboll (on behalf of Husqvarna and on specific Husqvarna products) in 2022 found that the energy need in kWh is almost 9 times higher for a conventional diesel front mower compared to a battery-powered commercial robotic mower.

Lower carbon footprint

Many golf course managers and head-greenkeepers are looking for ways to reduce their carbon footprint. Switching to robotic mowers can play a role towards achieving this goal. In the Ramboll comparison (see above) the robotic mower had an 83% lower climate impact[9] over its life cycle, when calculated in Global Warming Potential (kg CO_2-eq). These figures were calculated using a typical EU grid mix and would be even better if the electricity came from renewable sources like hydro and wind power. For this reason, many users of robotic mowers are installing solar panels to power their mowers, reducing their climate impact and energy costs even further.

Lower maintenance costs

Another of the most appealing benefits of robotic mowers versus conventional is the money golf courses can save on service costs, as most robotic mowers are easy to maintain. A quick brush or rinse is usually sufficient and changing blades are done in minutes. Gone are the days of the time-consuming and skills-demanding process of sharpening cylinder and rotary mower blades. Lubricating axels, changing belts and servicing internal combustion engines are also a thing of the past.

"IN A CHANGING WORLD THE GOLF INDUSTRY IS FACING MULTIPLE CHALLENGES; LABOR SHORTAGES, ENVIRONMENTAL CONSTRAINTS, BUDGET RESTRICTIONS... ONE OF THE RESPONSES TO THESE CHALLENGES LIES WITH THOSE LITTLE ROBOTS."

ERWAN LECOCQ, HEAD GREENKEEPER AT WINSTONGOLF IN GERMANY

Less noise pollution

Noise pollution presents a real challenge for many golf courses, with the noise produced by fossil fuel-powered mowers and handheld equipment becoming increasingly unpopular with players. Battery-powered mowers solve this problem and also help avoid complaints from area residents and businesses. As a bonus, quiet mowing allows for earlier tee times, which can help enhance club revenues.

Can reduce soil compaction

If the soil is too compact, the quality of the turf will quickly deteriorate, which is why greenkeepers employ various aeration strategies such as aerating and scarifying. Compared to conventional fairway mowers, with a total weight often exceeding 1000kg, autonomous mowers are very light and can be found in the weight range of 15 to 75kg. Their lighter weight gives them reduced ground pressure which causes less soil compaction compared to heavier machinery. This means that water is more easily absorbed, allowing the turf to be cut earlier in the spring and later in the fall, effectively making the playing season longer.

Safety aspects

On courses with steep undulations, the risks of slipping and rollovers are also present - not to mention the constant wear and tear on the greenkeeper's body from working on steep inclines. Battery-driven autonomous mowers have none of these drawbacks and can improve the working conditions for the course maintenance crew.

Common misconceptions

Higher initial investment cost

With a wide range of options, there investment levels vary accordingly. What is important to remember is that autonomous solution investment levels should not be compared with traditional mowers since autonomous solutions don't require an individual operator per machine, nor fuel or regular maintenance cost. In many cases, users can recoup their investment within a few years. Costs savings can vary depending on different scenarios, so for more detailed savings information please contact your local Lister Wilder branch.

Complex grounds

A common misconception is that robotic mowers are suitable only for well defined, flat courses with few obstacles. But while not every layout is right for a robotic mower, the best of today's commercial units can easily cope with uneven grounds that have multiple linked areas and severe slopes of up to 70%, as well as deal with tough terrain, ruts and other impediments.

What to look for when buying a commercial robotic mower

Commercial robotic mowers now come in all shapes and sizes. This makes them suitable not only for cutting the course itself, but also for maintaining driving ranges, as well as smaller turf areas around club houses and other facilities around the course. However, there are some common parameters to contemplate when evaluating quality and performance. Begin with this list of seven considerations:

High level of autonomy
Not all robotic mowers can be considered truly autonomous. Some require supervision during operation and manual daily start and battery charging. To provide the biggest increase in productivity, a robotic mower should be capable of unsupervised, continuous operation and automatic charging.

Handling real-life conditions
A commercial robotic mower must be able to handle real-life complexities and work around all sorts of obstacles. It must be able to navigate islands, and especially important for smaller products, steep slopes, narrow passages, irregular shapes, and sharp corners smaller than 90 degrees.

Uneven surfaces
A robotic mower must be able to guarantee consistency when it comes to cutting heights. Successfully reaching challenging areas is not enough. Robotic mowers must also be able to handle uneven surfaces meanwhile creating a dense and healthy result and avoiding tracks from repetitive routes across the turf.

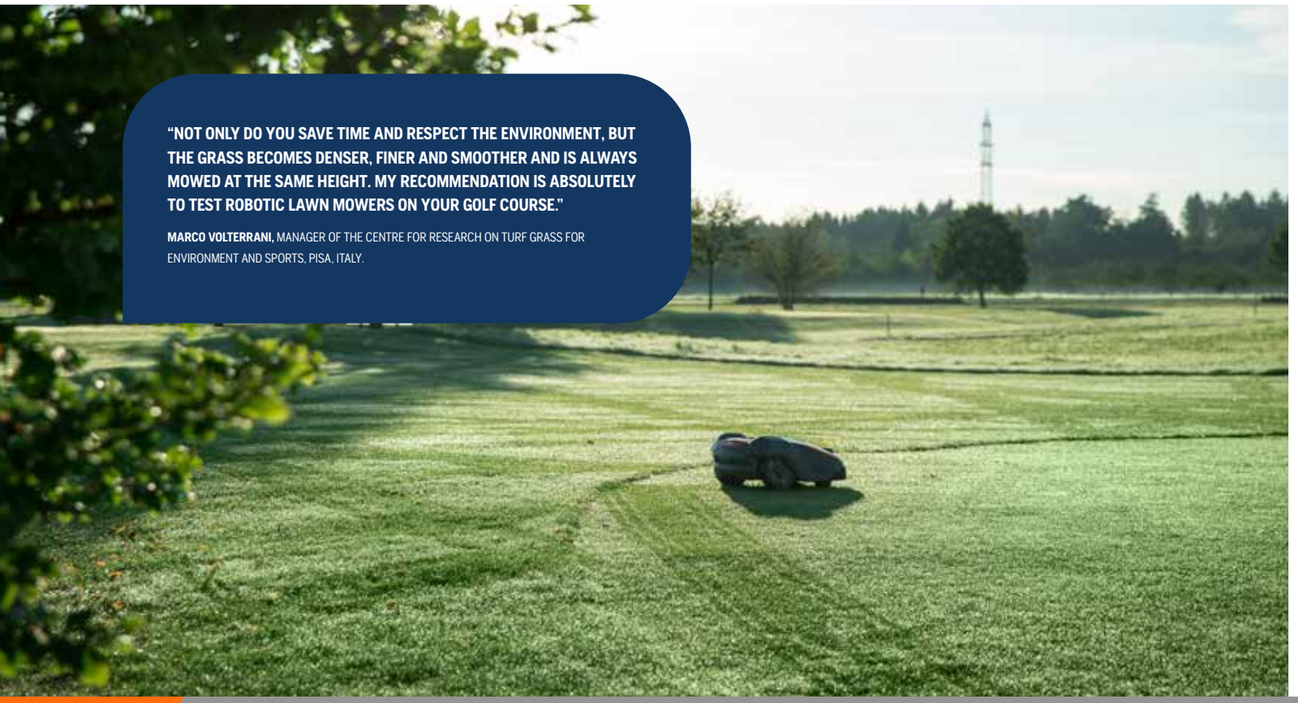
Easy to work with
Even with hardly any human interaction required, robots still need to be easy to work with when adjusting height of cut, storing during the winter etc. It is also a plus if they come with good access to service and support.

All weather compatible
A robotic mower is installed to remain out on the golf course throughout the season, which makes durability an important factor. Harsh weather conditions can play havoc with electric tools, yet commercial robotic mowers are increasingly designed to be able to work in all weather conditions. A mower should also be able to operate in wet weather and on wet grass.

Reliable over time
Considering the investment required to employ a robotic mower, a key requirement is that it is reliable over time and does not require constant manual supervision. Poor quality models need frequent manual restarts or additional work due to poor performance.

Low energy consumption
Even though most battery-powered mowers can be run at a fraction of the fuel costs for conventional mowers, efficient energy management is still important from a cost and sustainability perspective.

Fleet services
The ability to monitor and control numbers of mowers from a single platform, as well as the possibility to make software updates automatically, over the air, is a must for professional users.



"NOT ONLY DO YOU SAVE TIME AND RESPECT THE ENVIRONMENT, BUT THE GRASS BECOMES DENSER, FINER AND SMOOTHER AND IS ALWAYS MOWED AT THE SAME HEIGHT. MY RECOMMENDATION IS ABSOLUTELY TO TEST ROBOTIC LAWN MOWERS ON YOUR GOLF COURSE."

MARCO VOLTERRANI, MANAGER OF THE CENTRE FOR RESEARCH ON TURF GRASS FOR ENVIRONMENT AND SPORTS, PISA, ITALY.

"MY STAFF HAVE WELCOMED THE CHANGE, AND THEY ARE STARTING TO UNDERSTAND WHAT THE MACHINE CAN DO AND WHAT BENEFITS IT BRINGS."

STEVE LLOYD, WORCESTERSHIRE GOLF CLUB, GREAT BRITAIN.

What might the golf course of tomorrow look like?

While today's models are already quite capable, the autonomous mowers that will maintain the golf courses of the future will be able to tackle even more complex tasks. Improvements in battery and sensor technology, in combination with artificial intelligence and machine learning, will ensure that robotic machines will not be used only to mow, but also for other tasks like gathering of data on turf, weeds, irrigation, soil, damages, pest control etc.

This information will help head-greenkeepers manage their golf courses even better by creating a prerequisite for improvement work. They will be able to make more efficient use of their time by making smarter choices in relation to turf quality, where to allocate resources etc. Golf courses will also be able to provide extensive data to municipalities and other stakeholder to show how they are working with sustainability improvements. All of this will be increasingly important as weather conditions become more erratic and the use of "short cuts" in the form of chemicals gets more and more restricted.

Over the coming years, autonomous mowers will become increasingly smarter and "speak to each other" by sharing data between the units. This will give them new capabilities such as being able to work according to "area-centric" settings and entirely keep out of the way of the players on the course. Other possible features could be the ability to identify, and automatically fill in, divots or mark areas that need special attention from the greenkeeper.

The change to autonomous battery-powered mowers will most likely impact the design and construction of new golf courses in the future. Their lighter weight and smart features can give course architects more freedom of creativity with the creation of the layout and open up new possibilities; for example islands, narrow passages, smaller pedestrian bridges or other features that the can mowers easily pass, cut or work around.

Conclusion

Currently, more and more head-greenkeepers and golf courses are investigating whether they should invest in commercial robotic mowers. There are a couple of weighty reasons for why they will perhaps need to.

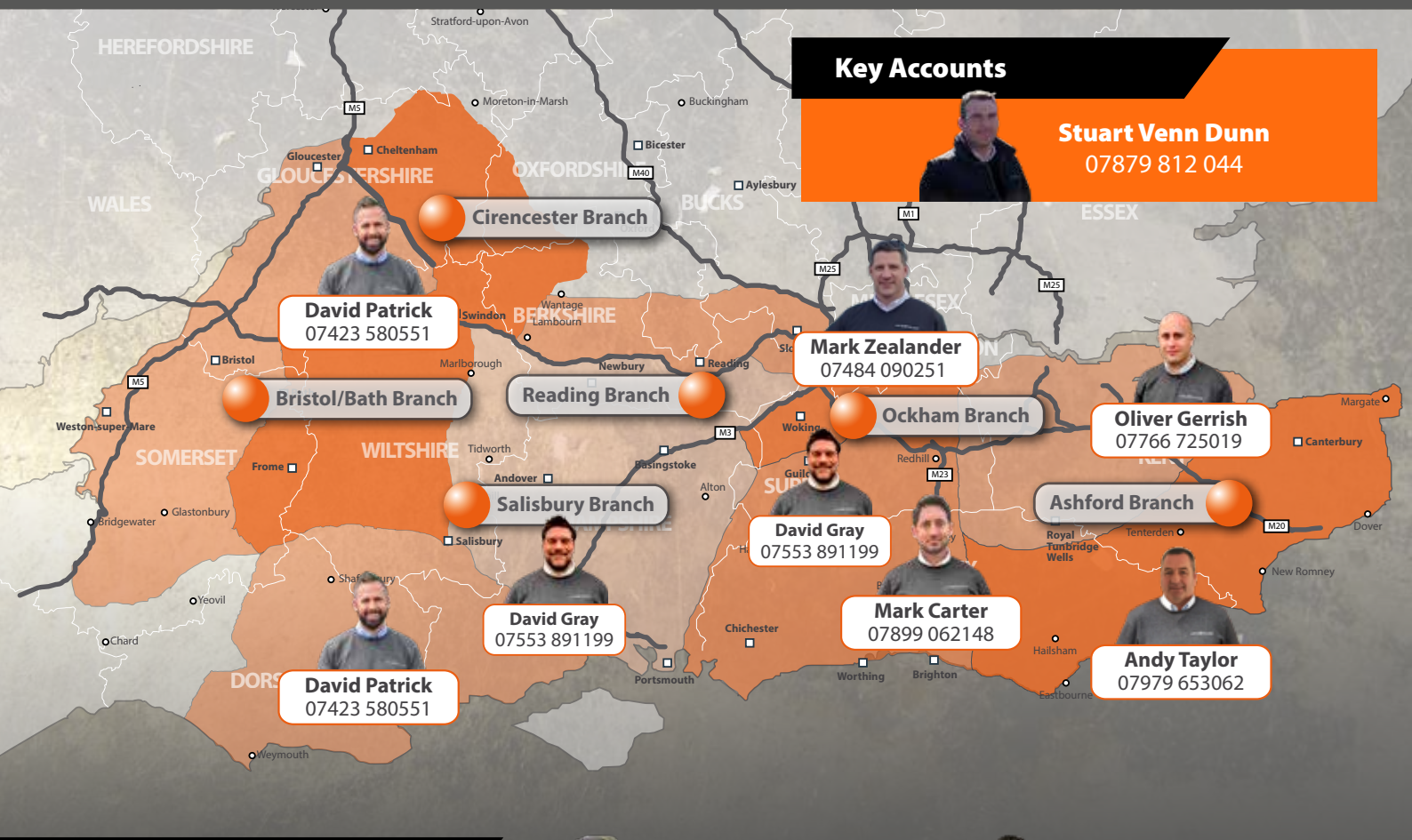
The first is that labour shortages show no signs of letting up[10]. This leaves golf courses scrambling for new solutions to achieve the turf quality that players demand – without driving up costs. The second is the overall societal shift towards more sustainable solutions where fewer and fewer people want to see greenkeepers using noisy and polluting gas-powered equipment. A fact that is mirrored in both current and coming regulations surrounding these issues.

So, has the time come to go autonomous? The short answer is yes. The technology represents a flexible and fully proven solution that lowers costs, improves the quality of the turf, alleviates labour problems and boosts sustainability by reducing the carbon footprint and decreasing noise emissions. The future of turf maintenance is indeed here.

Footnotes:

1. https://www.golfmonthly.com/features/5-biggest-challenges-facing-greenkeepers
2. https://www.bunkered.co.uk/golf-news/is-greenkeeping-in-crisis-new-survey-reveals-shocking-stat
3. Interview conducted in 21st January 2023, with Marco Volterrani, Giuliano Sciusco, Lisa Caturegli and Simone Magni from the University of PISA, Italy. The interview was conducted by Carolina Redman, Prime Public Relations, Stockholm, Sweden
4. Interview conducted 6th December 2022, with Karin Juul Hesselsøe, Researcher at Nibio, and Libya, the Norwegian Institute of Bioeconomy. The interview was conducted by Carolina Redman, Prime Public Relations, Stockholm, Sweden
5. The Antedote Pro Turf market opportunity study, 2021
6. Interview conducted 21st January 2023, with Marco Volterrani, Giuliano Sciusco, Lisa Caturegli and Simone Magni from the University of PISA, Italy. The interview was conducted by Carolina Redman, Prime Public Relations, Stockholm, Sweden
7. Grossi N., M. Fontanelli, E. Garramone, A. Peruzzi, M. Raffaelli et al. 2016. Autonomous mower saves energy and improves quality of tall fescue lawn. HortTechnology 26(6):825-830 (https://doi.org/10.21273/HORTTECH03483-16)
8. LCA of CEORA™ 546 EPOS™ & Rider P525DX Electrical & diesel driven, Ramboll 2022. The full report is available here: https://www-static-nw.husqvarna.com/-/files/aprimo/husqvarna/robotic-mowers/documents/letter/qk-274541.pdf?v=8e2c4e24
9. The comparison is made based on a scenario of a 30-week cutting season (an April–October season in North Europe) per year. The Lifecycle Assessment (LCA) is based on the functional unit of cutting two football pitches (16,000 sqm) of average pitch grass lawn. CEORA™ is powered by EU electricity grid mix and Husqvarna P 525DX is powered by standard diesel. Result in global warming potential per season (kg CO2e/season). Lifecycle assessment performed by accredited analyst firm Ramboll and reviewed by 3rd party reviewer Research Institute of Sweden (RISE), accessible at husqvarna.com/ceora-lca or husqvarna.com/lca-ceora
10. https://www.bunkered.co.uk/golf-news/is-greenkeeping-in-crisis-new-survey-reveals-shocking-stat

Area Sales Managers



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