EGO™

POWER BEYOND BELIEF™

LITHIUM-ION BATTERY VERSUS PETROL POWERED OUTDOOR EQUIPMENT

How to increase safety, productivity, sustainability and cost-effectiveness.

LITHIUM-ION BATTERIES CAN NOW MATCH THE PERFORMANCE OF PETROL

In the world of professional landscaping and grounds maintenance, petrol has been the fuel of choice for over 100 years – mainly because there has been no viable challenger. Recently however, battery powered cordless equipment has begun to gain worldwide popularity and increased market share, signalling the most significant shift in the sector for decades.

Three key factors are driving this trend: health & safety, the environment and economics.

In each of these, the benefits of lithium-ion batteries over petrol are overwhelming. Moreover, the emergence of new generation batteries and equipment by global manufacturers such as EGO™ means that lithium-ion batteries can now match the performance of petrol, without any of the drawbacks.

The tide is turning, and legislation may represent the final nail in the coffin for petrol.

STRINGENT EU LEGISLATION – THE END OF PETROL?

With an increasing focus on public health and the environment, the use of fossil fuels is under intensifying scrutiny, and legislation is already putting the squeeze on petrol.

In a recent announcement, The European Commission set out a transportation proposal to ban petrol cars from cities by 2050 – though many countries, such as Denmark, Norway and France, have brought this date forward. For grounds maintenance equipment, the timeline is being accelerated. Many US cities, including Los Angeles, have already banned petrol powered leaf blowers. In Europe, a number of municipalities, including Berlin, have followed suit. Similarly, health & safety organisations are looking more closely at accidents and injuries caused by petrol powered machinery, bringing more attention to the associated risks.

Legislation to counter these issues is becoming codified in European law, forcing businesses to pro actively seek new working methods to protect the well-being and welfare of employees.

THE HEALTH & SAFETY ARGUMENT

Equipment that is noisy, creates noxious emissions and vibrates at a level which can cause long-term muscular and vascular damage, quite apart from the risks to health, presents employers with significant challenges and costs.

HAND ARM VIBRATION

A common factor in petrol powered equipment, Hand Arm Vibration (HAV) causes numbness and muscle weakness which can lead to serious conditions such as Vibration White Finger (VWF), Carpal Tunnel Syndrome and even gangrene.

HAV is common in many industrial workplaces, not least grounds maintenance where the damaging effects of petrol powered tools such as leaf blowers, chainsaws, mowers and strimmers/brush cutters are widely recognised. According to Donald Peterson, Dean of the College of Science, Technology, Engineering and Mathematics at Texas A&M University-Texarkana. "(HAV) ... is probably the number one neuromuscular disorder in the world in manufacturing and construction environments, the most costly, and underappreciated." (1)

Financially, these costs can be punitive. In the UK, for example, personal injury claims range from £2,600 to £34,000 depending on severity (2), while in 2017 Wrexham County Borough Council was fined £150,000 for failing to address the issue of HAV in the workplace (3).

Such punitive costs aren't restricted to the UK and are being replicated throughout EU member states.

By law an employer must assess and identify measures to eliminate or reduce risks from exposure to hand arm vibration so that employees can be protected from risks to their health. Powerful directives are in place to minimise the risks of HAV, not least The European Physical Agents (Vibration) Directive (2002/44/EC) which sets a daily action limit of 2.5m/s^2 A(8) and an exposure limit value of 5.0m/s^2 A(8). Although figures vary by manufacturer, in general, battery powered outdoor power equipment vibrates at significantly lower levels than petrol powered equivalents. For comparison, a market leading petrol powered brushcutter (4) vibrates at 7.6m/s^2. In EGO™ cordless equipment, the equivalent figure is 2.175m/s^2 (5). Partly, this is because battery powered cordless machines don't require a combustion engine to power them. In addition, innovation is focussed on developing tools specifically to vibrate at the lowest levels whilst still maintaining high productivity levels. Falling well within the safety exposure values, battery powered cordless equipment is more comfortable to use and less likely to cause HAV, with a consequent knock-on effect for employee well-being and productivity, and employer peace of mind.

PERSONAL INJURY CLAIMS RANGE FROM

£2,600 TO £34,000

PETROL-POWERED BRUSHCUTTER

VIBRATES 7.6 M/S^2

EGO™ CORDLESS EQUIPMENT

VIBRATES 2.175 M/S^2

EMISSIONS

In 2017, one of Germany's leading environmental organisations looked at emissions from petrol powered outdoor power equipment.

The Deutsche Umwelthilfe e.V. (Environmental Action Germany) undertook extensive testing of 21 hand held engines (including motor saws and brush cutters) from European suppliers (6). Their research reveals that nine failed to comply with EU limit values for HC+NOx (hydrocarbons and carbon monoxide), while three also exceeded the limit value for CO(X). This is worrying, as the harmful impact of petrol emissions – especially benzene – are widely documented and understood, with regular exposure leading to 'a range of acute and long-term adverse health effects and diseases, including cancer and aplastic anaemia' (7).

Accordingly, the European Commission is making a concerted effort to minimise the damage caused by what it calls NRMMs – 'non-road mobile machinery' – including mowers, leaf blowers and chainsaws among others (8).

With zero chemical emissions during use, battery powered cordless equipment is unaffected by these directives – and will remain unaffected well into the future.

NOISE

The World Health Organization considers noise to be second only to air quality as the largest environmental cause of health problems (9).

Equally, on a website dedicated to noise pollution, the European Commission writes: "Prolonged exposure to noise can lead to serious health effects mediated by the human endocrine system and by the brain, such as... cardiovascular diseases, annoyance, cognitive impairment and mental health problems... (which can lead) to a loss of productivity of workers." (10)

Unsurprisingly therefore, European noise legislation is becoming ever more stringent with both the European Commission's Machinery Directive 2006/42/EC and the Outdoor Noise Directive 2000/14/EC (OND) looking to regulate noise emissions caused by some 57 types of outdoor equipment – including those used in parks and gardens. Furthermore, the new Physical Agents (Noise) Directive 2003/10/EC currently sets a maximum exposure limit of 87dB in working environments.

As shown in the table below, petrol powered equipment exceeds this at operator level. By comparison, the equivalent cordless equipment manufactured by EGO™ falls within the set limits.

Quite apart from the comfort and health benefits, the lower noise levels of battery powered equipment mean that it can be used at times, and in places, where petrol powered equipment may be prohibited – typically early mornings near sensitive areas such as hospitals, schools and visitor attractions. Battery powered cordless equipment is also subject to restrictions, but is better able to meet the stringent requirements. The net result is that workers can enjoy improved comfort, communication and teamwork, while their business benefits from less disruption and a continuous working schedule.

DID YOU KNOW?

PROLONGED EXPOSURE TO NOISE CAN LEAD TO SERIOUS HEALTH EFFECTS

Noise comparison table

PETROL CHAINSAW (AT 1 METRE)	105 DBA
BOEING 737 (AT 1 NAUTICAL MILE BEFORE LANDING)	90 DBA
MOTORCYCLE (AT 25FT)	90 DBA
PETROL LAWNMOWER (AT OPERATOR LEVEL)	98 DBA
EGO™ CORDLESS	
CHAINSAW (AT OPERATOR LEVEL)	85 DBA
MOWER (AT OPERATOR LEVEL)	87 DBA

Non-cordless equipment: source: http://www.industrialnoisecontrol.com/comparative-noise-examples.htm

Cordless equipment: EGO™ instruction manuals.

THE ENVIRONMENTAL ARGUMENT

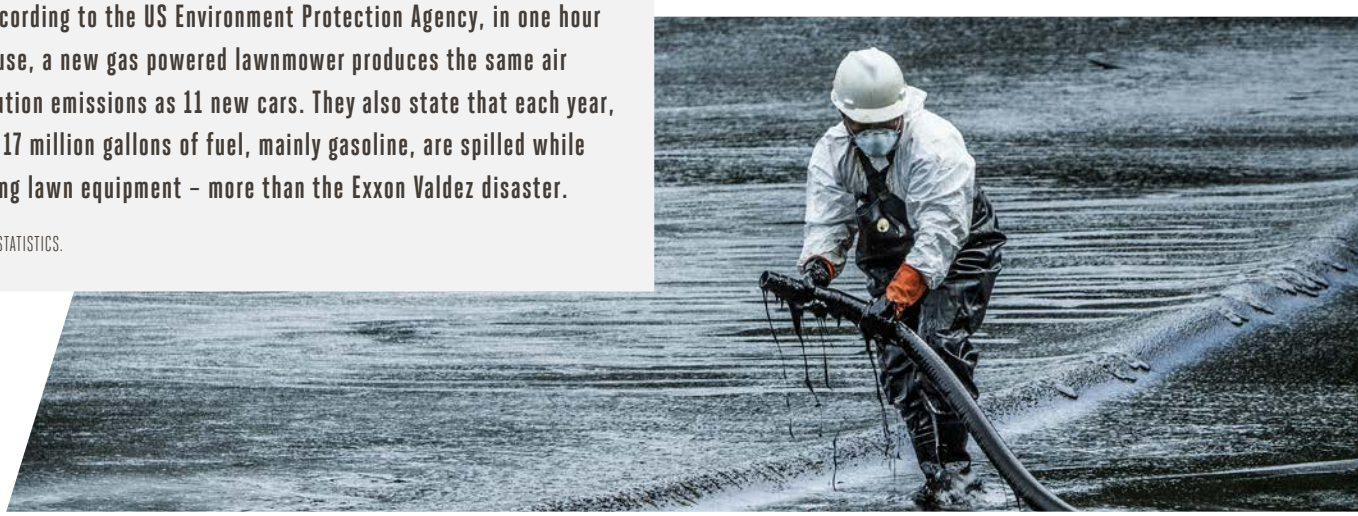
The sustainable agenda is here to stay, demonstrated by the notion of 'green cities' and initiatives such as the European Commission's 'Green Capital Award' and the Carbon Neutral Cities Alliance.

This collaboration of leading global cities is united in the goal of reducing greenhouse gas emissions by at least 80% by 2050 – and preferably sooner. Clearly, fossil fuels are not part of the long-term plan, and as both European and national governments force organisations to reconsider their environmental policies, the eventual elimination of petrol powered landscaping equipment is an inevitability. Next generation lithium-ion batteries such as those developed by EGO™ provide the only viable alternative, especially now that the challenge of recycling is being effectively addressed. In Europe, the USA and Japan, major automotive manufacturers are investing in this issue, and in particular on creating a complete life-cycle through partnerships and research programmes such as LithoRec, funded by the German Federal Ministry of Environment.

As a pioneer in electric powered vehicles, Tesla has also been hard at work in partnership with Umicore to establish their first 'closed loop' system which recycles lithium-ion batteries into completely reusable materials (11). Elsewhere, lithium-ion batteries are finding a 'second life' in homes and garages to recover and store solar energy. Potentially able to take advantage of renewable energy tariffs therefore, lithium-ion seems destined to take on an increasingly important role in the sustainability agenda adopted by private companies looking to maximise their environmental and economic advantage.

According to the US Environment Protection Agency, in one hour of use, a new gas powered lawnmower produces the same air pollution emissions as 11 new cars. They also state that each year, some 17 million gallons of fuel, mainly gasoline, are spilled while refueling lawn equipment – more than the Exxon Valdez disaster.

SOURCE: EPA STATISTICS.



THE ECONOMIC ARGUMENT

It is often pointed out that cordless equipment is more expensive than petrol, largely because of the upfront cost of the batteries.

While this can be true at purchase, over the length of a contract the story is rather different owing to the significantly lower costs of fuel (electricity v petrol) and a reduced need for maintenance and servicing. This is demonstrated in the table opposite. In this scenario, where a comparative range of hand held tools are purchased, the total cost of equipment and fuel for petrol powered equipment in Year 1 is €3,667, slightly less than the €4,433 for battery powered cordless equipment. In subsequent years, the latter has only the cost of electricity for charging the battery to meet, while petrol powered equipment faces higher fuel costs as well as regular maintenance and servicing. By the end of year two, the total running costs of battery and petrol are comparable, representing a 'break even' point. Each year thereafter there is a significant saving for battery powered cordless equipment. By Year 5, the total running costs of petrol totalled €11,294, compared with €6,226 for battery powered cordless equipment – representing a life-cycle saving of €5,068. This assumes a modest 170 days' work in each year. With more days, payback time would be accelerated.

It's important to note that the payback time of investment will be directly affected by the amount of 'idle' time, usage patterns, and even ambient temperatures which affect the energy capacity of the battery. Matching the right batteries to applications is therefore a critical consideration.

In addition to tangible cost savings, the use of battery powered cordless equipment can improve productivity by enhancing user comfort and welfare, and because it can be used in places where petrol powered equipment is either restricted or prohibited.

As part of its 2014 Procurement Directive, the European Commission encourages public authorities to consider this whole life-cycle cost, rather than just the initial cost of purchase (12). Although this philosophy of 'Green Procurement' has taken root in the public sector, it is increasingly being adopted by private companies looking to maximise their environmental and economic advantage.

COST OF PETROL POWER OVER 5 YEARS

€11,294

COST OF EGO™ OVER 5 YEARS

€6,226

TOTAL LIFETIME SAVING

€5,068

Cost of ownership tables

		PETROL					
		YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**	**TOTAL**
LITRES OF FUEL PER YEAR		680L	680L	680L	680L	680L	3,400L
FUEL COST (€/L)	€1.50	€1,020	€1,020	€1,020	€1,020	€1,020	€5,100
SERVICING		€300	€300	€300	€300	€300	€1,500
EQUIPMENT – BC	FS360 C	€949			€949		€1,898
EQUIPMENT – HT	HS82 T	€649			€649		€1,298
EQUIPMENT – LB	BR500	€749			€749		€1,498
TOTAL COST		€3,667	€1,320	€1,320	€3,667	€1,320	€11,294

		EGO™ COMMERCIAL SERIES					
		YEAR 1	**YEAR 2**	**YEAR 3**	**YEAR 4**	**YEAR 5**	**TOTAL**
KWH/DAY REQUIRED		2.50KWH	2.50KWH	2.50KWH	2.50KWH	2.50KWH	
KWH/DAY AVAILABLE		3.13KWH	2.94KWH	2.72KWH	2.54KWH	2.50KWH	
CHARGE CYCLES PER YEAR		170	170	170	170	170	850
ELECTRICITY COST (€/KWH)	€0.30	€160	€150	€139	€129	€128	€706
BATTERY + HARNESS	BAX1501	€1,399					€1,399
BATTERY	BAX1500	€1,329					€1,329
CHARGER	CHX5500E	€298					€298
EQUIPMENT – BC	BCX3800	€449			€449		€898
EQUIPMENT – HT	HTX6500	€399			€399		€798
EQUIPMENT – LB	LBX6000	€399			€399		€798
TOTAL COST		€4,433	€150	€139	€1,376	€128	€6,226

BREAK EVEN	**YEAR 2**		
	PETROL	BATTERY	**SAVING**
COST YEAR 1	€3,667	€4,433	-€766
COST YEAR 2	€1,320	€150	€404
COST YEAR 3	€1,320	€139	€1,585
COST YEAR 4	€3,667	€1,376	€3,876
COST YEAR 5	€1,320	€128	€5,068
TOTAL COST OF OWNERSHIP	€11,294	€6,226	
SAVINGS AT YEAR 5	€5,068		

- COST ESTIMATES ARE BASED ON PURCHASING A BRUSH CUTTER, HEDGE TRIMMER AND LEAF BLOWER IN YEAR 1 AND REPLACING AGAIN IN YEAR 4
- PETROL FUEL EQUIVALENTS ARE DAILY USAGE OF 4 LITRES PER DAY AND 170 DAYS PER YEAR

Cleaner, greener and more cost-effective, battery powered cordless technology isn't just a viable alternative to petrol, it's a better alternative. All of which presents a powerful case for switching to battery sooner rather than later.

But in selecting a supplier, what factors do you need to consider?

THE BATTERY – THE KEY TO CORDLESS

Responsible for delivering both power and run time, the quality of battery is the defining factor in the performance of cordless equipment.

Is it powerful enough for your requirements? Does it recharge quickly, and can it hold the charge throughout a working day? Critically, can it be kept cool enough to prevent overheating and failure – a known problem with lithium-ion batteries (as Samsung discovered with its Galaxy smartphone).

Manufacturers around the world are investing in R&D to solve these challenges and take lithium-ion technology to the next level, with the automotive industry understandably at the forefront. One of the world's leading suppliers of battery powered cordless outdoor equipment, EGO™, has been quick to adopt these advances and is also one of the few equipment manufacturers to commit to an extensive R&D programme focused exclusively on battery powered equipment.

As a consequence, EGO™ has made significant advances in design and technology innovation, resulting in the EGO™ ARC Lithium battery.

In addition to setting a new standard for charge time and power, it offers an exceptional weight to energy ratio, making it among the top performing portable batteries on the market. For example, weighing less than 3kg, the 7.5Ah 56V BA4200 ARC Lithium battery has an impressive 420 watt-hour (Wh) capacity ensuring user comfort and long run times over an extended working period.

The pioneering ARC Lithium battery has also been developed to answer the most pressing questions around cordless equipment.

THE QUESTION OF OVERHEATING

To achieve the desired voltage and amp hours needed for grounds maintenance equipment, several smaller lithium-ion cells are brought together into a single pack.

In most battery powered cordless equipment, these are simply stacked together in rows in a simple 'brick' shape. In operation, this can concentrate heat, especially in the middle of the battery pack. If this heat becomes excessive, the battery management system will simply shut down the whole unit until the temperature of the battery pack returns to normal operational levels, even if just one battery cell is affected. This is fine for safety, but has a negative impact on productivity.

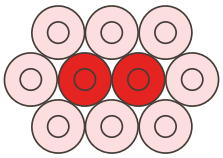
The EGO™ ARC Lithium battery incorporates several unique features to counter over-heating and to help batteries work harder, for longer and more safely. Key to this is a patented 'arc' design which ensures that every single battery has at least one side adjacent to an external wall of the casing, facilitating air cooling. The shape of the ARC Lithium design also results in a larger heat sink area when compared to traditional cube shaped batteries. In addition, patented 'Keep Cool' technology envelopes the individual battery cells in a 'phase change material' (PCM). Taking the form of a 'solid' phase, PCMs absorb heat like any sensible heat storage (SHS) material. However, unlike SHS materials, PCMs have a melting point. When this is reached, they change 'phase': i.e. they go from a solid to a liquid state. This allows them to absorb large amounts of latent heat at an almost constant temperature, which works to protect the battery and avoid overheating. This process continues until all the PCM is transformed to the liquid phase. Once the ambient temperature falls, the PCM solidifies, slowly releasing its stored latent heat. The net result is enhanced protection and safety, and a more reliable service life. The PCM allows use of the full capacity of the battery under heavy load (with high current). Without PCM cell temperatures rise faster to the limit and battery management stops discharging. Most batteries of other manufacturers cannot reach their possible capacity under heavy load.

These two innovations are complemented with a central processing unit (CPU) which monitors each individual battery cell to ensure a balanced charge and discharge, again resulting in a longer battery lifetime.

The EGO™ battery is also mounted to the outside of the tools rather than within an internal housing, which permits latent heat to escape easily, unlike many other battery powered brands.

Combined, these design features ensure safe and reliable operation in all environments, even during prolonged use.

BRICK SHAPE BATTERY



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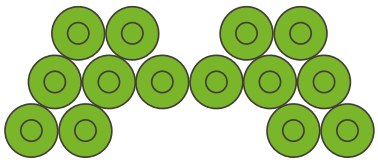

EGO™ ARC DESIGN

THE QUESTION OF CHARGING, RUN TIME AND STORAGE

As the demand for lithium-ion batteries increases, the supporting infrastructure for charging will also expand.

Along with the possibility for portable power banks to be carried by vehicles, there are strong signs that national battery charging infrastructures are edging ever closer. Across Europe, electric cars can already 'plug-in' to chargers at service stations, car parks and elsewhere, while the German company Ubitricity has even introduced charging ports on lamp-posts (13). Meanwhile, investment pours into the evolution of lithium-ion technology. Researchers at MIT for example are developing a new battery electrode which can deliver thousands of cycles without a loss in performance (14). The technology is truly future-proofed, and the time to invest is now.

The days when lithium-ion batteries failed midway through a job are long gone. To mitigate against this, EGO™ batteries use a combination of software and microprocessors to create an intelligent power management system which constantly monitors and manages each individual cell in the battery pack, ensuring optimal power, performance and run time.

Equally, EGO™ offers a suite of battery options – ranging from 2.0Ah (112Wh) to a high-density 7.5Ah (420Wh) battery – meaning there's a battery for every task.

There are other ways to ensure enough power to last a full working session, not least combining batteries into a backpack. For example, the BAX1500 (1500Wh) commercial backpack battery from EGO™ allows users to carry sufficient power output for a full day's work from a single charge. Backpack batteries bring an additional advantage – by removing the weight of the battery from the tool, they minimise arm fatigue and maximise comfort to permit extended working patterns.

Getting the balance of run time and charge time right can present a challenge to users, but is an important factor when considering which cordless brand to choose. EGO™ provides a full range of chargers to suit both application and budget. For hand held batteries there is a choice of a standard charger (CH2100E) or rapid charger (CH5500E), while all EGO™ chargers monitor the temperature of the cells to optimise battery health. The CH5500E delivers a charge time of just 40 minutes for the 5.0Ah battery. This is sufficient to deliver a run time of 60 minutes for the EGO™ HTX6500 commercial hedge trimmer. As run time exceeds the recharge time, two batteries can therefore be used in rotation to deliver an infinite run time.

The CHX5500E PRO charger, which can be used for both of the EGO™ backpack batteries, utilises an 'overnight' 7-hour charge cycle which is the optimum recharging speed, ensuring the maximum number of recharge cycles over the battery's entire lifetime. The CHX5500E also gives users the option to 'boost' the standard charge time by 50% if ever it's needed – such as when an additional charge is required to complete work on the same day.

Ultimately, the best approach to battery selection and management depends on applications and usage, and EGO™ offers training and support to help maximise both performance and longevity.

For optimal performance, safety and battery cell health, lithium-ion batteries should never be allowed to fully discharge. Equally, they should not be fully charged and then left unused for prolonged periods of time. All EGO™ batteries are equipped with microprocessors to manage this automatically. The microprocessor ensures the individual battery cells cannot be discharged below the recommended limit. In addition, if fully charged batteries are left unused for a number of weeks they will automatically discharge to 30% capacity ensuring the maximum lifetime of the battery.

THE QUESTION OF BATTERY PLATFORM

With battery powered cordless equipment, each brand requires its own specific battery, none of which are compatible with other manufacturers.

Indeed, the pace of change has been such that some manufacturers have introduced new batteries which aren't even compatible with other battery powered cordless equipment across their range!

All EGO™ batteries fit all EGO™ tools in the entire EGO™ range. It therefore makes economic sense to invest in only one or two platforms, and to ensure they're future-proofed and offer the range and quality your applications demand.

Importantly, unlike other manufacturers who impose price differentials across their battery range, the cost of buying multiple single batteries from EGO™ is exactly the same as buying their equivalent in a single backpack. In short EGO™ batteries are equally priced at the cost per Wh.

All EGO™ portable batteries and tools carry International Protection Marking IPX4 – while the BAX1500 battery holds an industry leading IP56, defined as: 'water from heavy seas or water projected from jets shall not enter the machine in any harmful quantity.'

PRODUCT QUALITY AND PERFORMANCE

When considering the move to lithium-ion it's important to choose a platform that delivers performance equal to or greater than the petrol powered equivalents they are set to replace.

The new EGO™ Power + commercial series of hand held tools has been specially developed to meet the needs of the professional market. Designed with the user in mind to ensure comfort, durability and high performance, the range consists of a blower, hedge trimmer and brush cutter.

Each tool in the range features a high efficiency brushless motor to maximise performance, prolong product lifetime and reduce vibration. Importantly for outdoor work, they deliver impressive run times and are housed in robust weatherproof casing for extra protection. Each also incorporates unique features for the professional market:

- The BCX3800E brush cutter has a carbon fibre shaft which has been strength tested to 150kg loads, helping prevent bending during use and in transit – a common problem associated with this type of tool.
- The HTX6500 hedge trimmer features a diamond-ground, laser-cut and laser-hardened blade which stays sharper for much longer than standard blades.
- The LBX6000 leaf blower has a maximum air force of 21 Newtons, outperforming many of its petrol equivalents – but with a sound level that, at 80dB, is among the quietest on the market. This means it can be used in environments where noise sensitivity is particularly acute.

Individually and combined, these features ensure reliable performance and an extended service life, in even the most arduous working conditions.

SERVICE AND SUPPORT

Battery powered cordless equipment needs less service and maintenance than petrol powered machinery, but it does demand specialist know-how and equipment so you should look for a supplier with a strong infrastructure and track-record of training and support.

EGO™ has a local network of specialist machinery dealers throughout Europe who are able to provide face to face support, expert advice and servicing, with spare parts availability of 99%. This ensures downtime will be kept to a minimum.

With over 25 years' cordless experience and a global presence, EGO™ is one of the most established manufacturers in this sector, and is committed to working with clients to create bespoke solutions for each and every individual need.

CONCLUSION

With rising energy costs and concerns over health, safety and the environment, the use of petrol powered outdoor equipment has come under increasing scrutiny and is now subject to ever more stringent legislation.

Against this, battery powered cordless technology has improved significantly and now offers similar – if not better – performance than petrol alternatives.

1. **By reducing accidents and injury, cordless equipment enhances worker safety and well-being.**
2. **By delivering long-term cost savings, it helps improve business efficiency.**
3. **And by minimising pollution, it contributes positively to our environment. In other words, it offers petrol-matching power, without any of the downsides.**

As a result, the industry now recognises cordless as a truly viable alternative to petrol. And with the superior and proven performance of its revolutionary battery and product range, EGO™ is well placed to help business realise the benefits.

Notes on EGO: EGO™ is built on innovation. Part of an international manufacturing business established in 1993, we've pushed the boundaries of cordless technology from the very first days. Today we're one of the world's biggest tool manufacturers, producing over 10 million units each year, selling in 65 countries worldwide. EGO™ is 100% dedicated to the advancement of cordless technology within the outdoor equipment industry and we want to ensure that when people consider cordless technology they think of EGO™ as the brand to turn to because only EGO™ has all of the answers.

For further information visit www.egopowerplus.com or email: eu.support@egopowerplus.eu

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