

# All-electric battery-powered drill rig successfully tested in the UK

The world's first all-electric battery-powered geotechnical drill rig has been put to the test in the UK for the first time by JKS Boyles UK Ltd and Dynamic Sampling Ltd

**J**KS Boyles, a Comacchio dealer for 26 years, assisted by Dynamic Sampling, has been thoroughly testing Comacchio's all-electric, battery-powered eGEO 405 to understand the rig and its battery capabilities.

Nathan Jones, managing director at JKS Boyles, said: "Throughout testing, the rig performed very well, drilling holes to 40m. These holes consisted of coring 16.5m using Geobor S followed by open holing at 6in diameter down to 40m through clay, sandstone and mudstone."

Joe Taylor, lead driller at Dynamic Sampling, added: "I was really impressed with the rig in general and the battery life. There was plenty of power when drilling, even when the torque was on a low setting. Using a Geobor S none coring device usually puts a lot of strain on rigs when drilling due to the sheer volume of material that must be lifted from the hole. The eGEO 405 coped perfectly and didn't struggle at all."

The team reported that tracking the machine to the borehole location, drilling, recovering, washing down the rig and moving to the next location took 6.5 hours, which depleted the onboard battery by 60%.

"The rig exceeded all expectations. Our initial predictions were that we would need at least one battery change during a day's shift, but this is not the case. The eGEO 405 has proven it can complete a full shift on a single charge," Jones said:

Pete Stanojevic, managing director at Dynamic Sampling Ltd, said: "From what I saw, the rig worked really well, and the



*Rowan McGee, Owen Maycroft and Joe Taylor, the drill crew from Dynamic Sampling who assisted JKS Boyles with the UK field trials of the battery-electric Comacchio eGEO 405 drill rig*

batteries lasted well, too. It's very impressive."

## BATTERY TECHNOLOGY

Comacchio designed the eGEO 405 to take a major step towards a whole new technology that is based on the use of lithium-ion rechargeable batteries.

The rig is complete with two removable battery packs and a standalone battery charger to ensure continuous operations even under "extreme load" conditions. Switching out a depleted battery with a fully charged one can be done in minutes. The battery

system is compact, placed on the rear of the machine in a separate and exchangeable box, designed to be easily handled using a forklift, telehandler or other ancillary lifting equipment.

The 33kW charger has been designed to ensure the spare battery pack is fully charged by the time the onboard battery is depleted, allowing for continuous drilling. The eGEO405 also has an onboard charger, allowing the rig to be plugged directly into mains power.

The standalone charger allows the spare pack to be charged in ▶

**"The eGEO 405 has proven it can complete a full shift on a single charge"**



*Comacchio's battery-electric eGEO405 in testing in the UK showing one of the removable battery packs on the rear of the machine*

less than two hours from 15% at a mains supply or via battery storage systems. Based on the results of the UK tests, the manufacturer is confident that there will be no "charge anxiety" when using the eGEO 405.

Jones noted: "The sustainability and financial benefits of the eGEO 405 are huge and are expected to be a driving factor in the adoption of this kind of rig in the UK and the rest of the world."

The use of this machine will save up to 310kg of CO<sub>2</sub> in an eight-hour shift due to saving 130L of diesel. The cost of charging a battery pack is estimated to be £20 compared to

£200 to fill the diesel tank of the eGEO 405's diesel counterpart. This is a saving of £900 a week—£45,000 annually. Ideally, if the batteries are charged from green energy sources, the eGEO 405 generates completely zero emissions.

"It was a nerve-racking start to testing when we broke ground for the first time knowing the time and effort put into the development of such a project, and wondering whether the rig would do what it was actually designed to do.... drill. As the rig progressed, and we were taking the first-ever core samples using a fully battery electric geotechni-

cal drill rig, the nerves became more excitement as to what we are now able to offer the industry as we look to a more sustainable future. The eGEO405 is a world first, and it works," Jones said.

"All parts of the rig seemed very responsive to the levers with no delays when using them. The triplex and mist pump also worked very well under the electric motor and seemed to have more than enough power for what we needed," Taylor added.

### **PUBLIC DEBUT**

The rig was presented for the first time during the bauma exhibition in Munich, Germany, in 2022 and in the UK at the Geotechnica exhibition in 2023.

"The success it enjoyed with the public is proof that the demand for sustainable technologies is growing at a very fast pace.

"The eGEO 405 is a masterpiece of technology and innovation: it is the first battery-powered electric drill rig in our range and is currently the first fully electric rig designed for soil investigation and mineral exploration applications available on the market," Emanuele Comacchio, technical and sales manager at Comacchio, explained.

Comacchio has extensive experience in supplying electric drill rigs that are based on the use of three-phase motors connected to a mains supply. These are often required when there is a need to operate fume-free, for example, inside buildings and small tunnels. The electric motor is fitted onto the rig in place of the diesel engine. This can be driven from a three-phase mains supply or a mobile diesel generator located outside, where fume build-up is not a problem. This has been a common option on drill rigs for many years. However, with the eGEO 405, Comacchio wanted to challenge the status quo.

The 'heart' of the eGEO405 is the battery pack, which consists

of a modular battery system. The battery system delivers a total energy capacity of 78kWh and reaches a nominal voltage of 350VDC. It is characterised by high energy density, scalability and extensive safety features. The manufacturer said that the eGEO405 is robust against all conditions and excels in applications requiring high peak power, fast charging and a high number of charging cycles.

### OVERCOMING CHALLENGES

“The biggest challenge in electrifying a drilling rig is integrating the batteries into a piece of equipment designed to accommodate a thermal powertrain. We developed the battery system and the power management from the ground up, including designing and implementing a software solution to effectively and safely manage power and energy between the batteries, the inverters and the electric motors powering the rotary head and the main loads of the rig. The power supply of the machine is controlled using CANBUS technology, allowing all the components to communicate with each other and managing the current flow from the battery according to the actual operating needs. The machine’s operating parameters can be viewed on a display located on the control panel,” said Emanuele Comacchio.

The eGEO405 is equipped with a 6500daN retract mast and a 3500mm stroke. The high-performance rotary head can reach 850daNm peak torque and a speed of 650rpm. It can be operated in slow and fast gear, with the advantage that the adjustment of torque and rpm according to the actual operating conditions can be carried out in an extremely precise manner. The machine is equipped with a mud/water pump (with a max flow rate of 200L/min and max pressure of 45 bar) and a 600kg wire-line winch with an automatic guide device. The eGEO 405 also

features a rod rack holding up to 84m of rods on board.

### COMPACT AND FLEXIBLE

The overall dimensions of the eGEO 405 are very similar to those of the diesel engine equivalent, keeping the machine as compact as possible to facilitate transport. It is designed to perform as well, if not better, than the diesel-powered equivalent GEO 405. Regardless of the drilling method, it can offer the same functionality and provide the maximum required power, covering the full spectrum of applications connected with site investigation programmes.

The eGEO 405 enables drillers to carry out open-hole rotary drilling, hollow or solid stem auger drilling, conventional and wire-line coring and DTH drilling. The rotary head’s multipurpose design allows for multiple drilling types with minor changes to the machine. This operational flexibility results in reduced downtime and lower total cost of ownership.

The safety features of the machine include protection against moving parts, such as an interlock-

ing guard, meeting the European requirements of EN 16228.

The eGEO 405 can also be equipped with a data logging system, including ComNect, a remote monitoring software developed by Comacchio that provides data for machine diagnostics and operational analyses.

“While creating the eGEO 405, we have chosen the most proven electrification technology available on the market in order to provide reliable operation in any operating conditions,” Emanuele Comacchio said. He continued: “We are approaching companies that are willing to become early adopters of new technologies. Carbon reductions will become a more important differentiator as many companies want to score well on key environment, sustainability and governance (ESG) performance indicators, which is increasingly important to investors. Such ambitions will likely accelerate in the next few years, and Comacchio is committed to exploring new solutions, including not only purely battery-electric drives but also hydrogen-powered motors.” ▼

**“We have chosen the most proven electrification technology available”**

## The eGEO 405 benefits

### Higher efficiency

Deisel-run hydraulic drill rigs are estimated to lose 60% of the fuel energy due to thermal loss and another 30% due to the hydraulic system. Electric engines deliver 90% of energy at the output shaft and are, therefore, considered the most efficient option. Moreover, using electric motors eliminates energy losses and fuel consumption connected to the idling times of hydraulic pumps and diesel engines. With an electric drill rig, the current output from the battery is provided according to the actual load, accumulating operating hours only when truly in operation.

### Low noise

Noise pollution is an underestimated threat to health and safety. Even the latest diesel engines are noisy, whereas electric drill rigs are extremely quiet. The eGEO 405 will help remove noise distraction, enhancing both on-site productivity and safety. “It was quite

strange the rig being silent but not listening to a big diesel engine all day was brilliant,” Joe Taylor, lead driller at Dynamic Sampling, said.

### Reduced maintenance

Electric drives require much less maintenance than conventional combustion engines. Electric drill rigs have far fewer parts than their diesel alternatives, which means fewer breakdowns, longer service intervals and less maintenance. Additionally, the lifetime of an electric motor is much longer.

### Operational precision

High-performance motor control provides accurate speed and torque adjustment, offers smooth rotation over the entire speed range, and has the advantage of sustaining full torque at zero speed and fast acceleration and deceleration. This enables greater control of drilling parameters, resulting in faster and higher-quality drilling.