New instrument accelerates soil analysis when laying underground cables

Pictured is the VARIOS soil analyser

Labcell is launching the VARIOS instrument for automatically generating thermal dryout curves for soil samples. Manufactured in the USA by METER Group, the new VARIOS offers substantial benefits to companies laying underground high-voltage electric cables. It saves time and cost during planning and construction, as well as improving reliability and energy efficiency when cables are in use.

A cable's electrical resistance causes heat to be generated when a current flows. As the cable's temperature rises, its resistance increases further and causes more heat to be generated. Ultimately, the cable can suffer from thermal runaway and fail catastrophically. To avoid this situation, it is vital that heat is conducted away from the cable to stabilise its temperature. With underground cables, heat dissipates through the backfill material and soil around the cable, so it is imperative to understand the soil's thermal properties.

Traditional laboratory methods for analysing soil thermal properties have been time-consuming, costly and prone to human error. The new VARIOS instrument offers a cost-effective alternative that delivers higher-quality data more quickly and easily, while eliminating the risks associated with human error.

METER developed the VARIOS to support the 2GW SuedLink (SüdLink) Project in Germany. This ‘electrical superhighway’ will link North and South Germany. When weather conditions are windy, SuedLink transmits electricity from wind farms in the North to power homes and businesses in the South; when the weather is sunny, solar energy from Southern Germany is transmitted to the North. If there is insufficient wind or sun, SuedLink can import energy from Norwegian hydroelectric power stations. At 700 km from end to end, SuedLink is the longest underground power cable in the world. In fact, there are two high-voltage DC transmission lines laid in parallel.

SuedLink is a critical piece of infrastructure for Germany and reliability is paramount. Given the electrical energy that will be transmitted over the cable’s lifetime, efficiency is also a high priority. Finally, the scale of the project required thousands of samples to be tested to provide accurate soil data along the length of the cable. These factors highlighted the need for a soil thermal properties analyser that was cost-effective, accurate and easy to use.

METER developed the VARIOS from two of its existing, proven products. The first is the TEMPOS thermal conductivity instrument with a TR-3 sensor probe, while the second is the HYPROP water potential and water content analyser. Plotting data for thermal conductivity, water potential and water content over time provides high-resolution dryout curves (also known as dry down curves). By studying these, it is possible to determine the optimum backfilling for the trenches in which high-voltage cables are being buried. This, in turn, ensures sufficient heat is conducted away from the cables for efficient and reliable transmission of electrical energy.

Compared with the alternatives, the VARIOS is an easy-to-use, versatile, reliable, time-efficient and cost-effective way to generate dryout curves automatically. The new instrument conforms to the two key international standards IEEE 442-2017 (thermal resistivity measurements of soils and backfill materials) and ASTM D5334 (determination of thermal conductivity of soil and rock by thermal needle probe procedure). With its low heat input and short heating phases, the VARIOS minimises water movement due to heating and thermal convection, resulting in reliable measurements. Automatic temperature drift correction, high accuracy of ±0.1°C and fine resolution of 0.01°C help to generate high-quality data plots.

The VARIOS comes as a complete, ready-to-use kit that includes software for data acquisition and analysis.