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WORLDWIDE INDEPENDENT POWER

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WORLDWIDE INDEPENDENT POWER

PROMOTING ON-SITE POWER & CO-GENERATION

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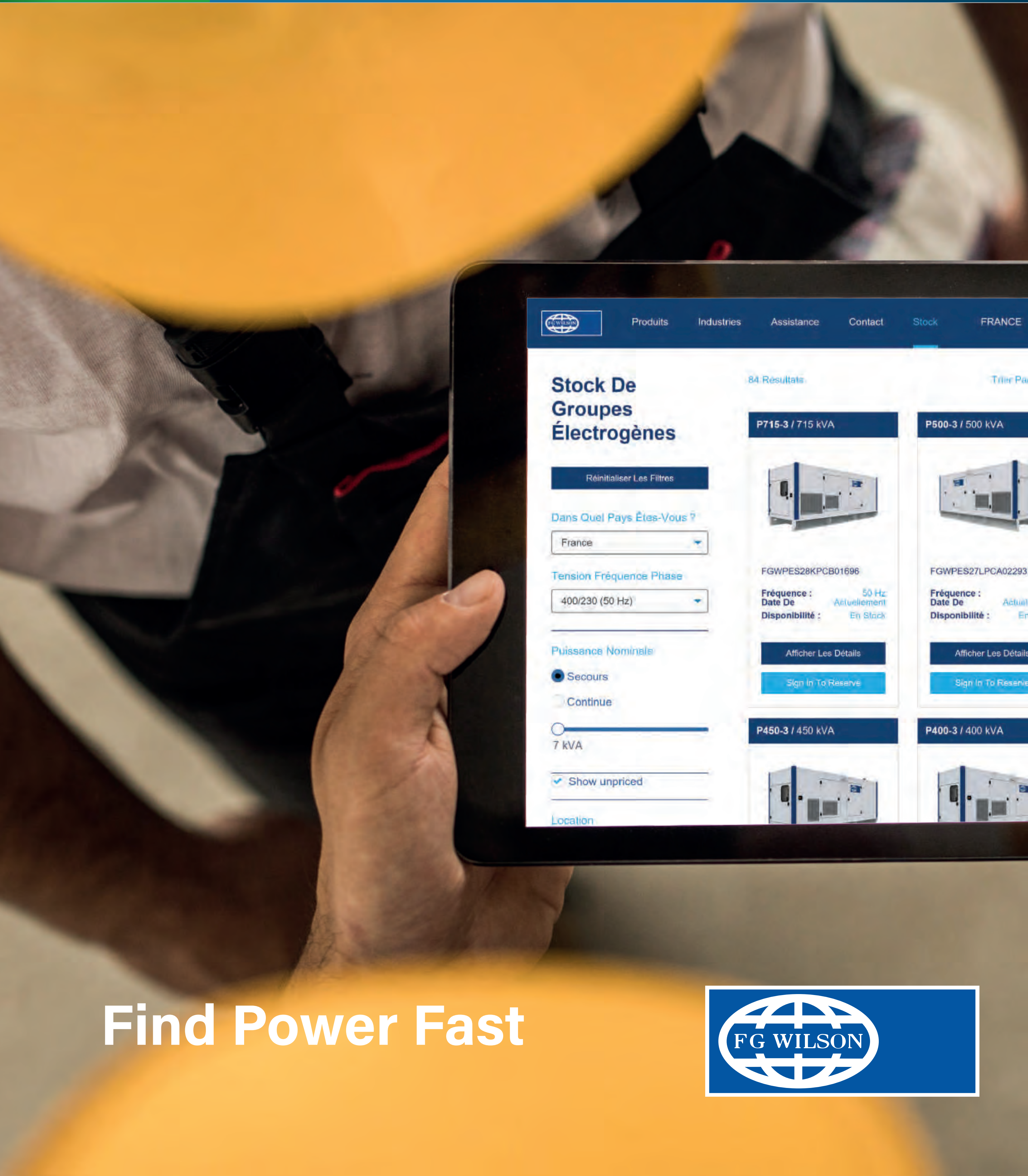

POWERING UP AMONGST THE ICE

In a 'technology-first' the UK is operating one of its major Antarctic bases - the Halley station, located on the Brunt Ice Shelf, Antarctica - in fully-automatic mode for the first time. The facility is currently running experiments which include the monitoring of the ozone layer, cosmic radiation analysis and data on global warming trends.

The base would normally be crewed all-year-round, even through the permanent darkness of winter when typical temperatures fall below -20 °C (with extreme lows of around -55 °C recorded). Personnel have already been withdrawn because of uncertainty over the stability of nearby ice. Scientists believe that a giant ice sheet the size of Greater London is about to break away from the Brunt, and officials from the British Antarctic Survey (BAS) have evacuated its researchers away from the area until Polar summer returns. Information gathered by Halley station has proved invaluable - data from Halley led to the discovery of the ozone hole in 1985.

Maintaining power has always been a big issue for the base. On 30th July, 2014, the station lost its electrical and heating supply for 19 hours. During the power cut, there were record low temperatures. Power was partially restored, but all science activities, apart from meteorological observations essential for weather forecasting, had to be suspended. This prompted the UK's polar research agency to develop a standalone power unit to provide electricity for the station's priority science activities in what is now the third winter shutdown on the trot.

Currently providing energy for key base experiments is the Capstone Turbine C30 micro-turbine which is turning at 70,000rpm, 24-hours-a day, to generate a constant 9kW of power. The system has been working without a hitch since its installation in February 2019, reports BAS.

The C30 is part of the Capstone range of clean and green microturbines, which are scalable from 65kVA to 10MW and can operate on a variety of gaseous or liquid fuels.

The microturbine's operation utilises the Brayton cycle. In this cycle, the compressor first raises the pressure of the ambient air to the required pressure ratio.

The compressed combustion air is then routed through a non-mixing exhaust-to-air heat exchanger called a recuperator. The recuperator allows the microturbine to utilise a portion of the exhaust energy to preheat the incoming combustion air. By using preheated air in the combustion process, less fuel is necessary to obtain the exhaust temperature required for expansion across the turbine. This results in an increase in the overall fuel-to-electrical efficiency of the microturbine.

In the next step of the cycle, the compressed and preheated air is fed to a combustor where it is mixed with the fuel and hence burned. This combustion process releases energy in the form of heat. The heated combustion exhaust gases are expanded through a gas turbine to drive the rotation of the central shaft and its attached compressor and permanent magnet generator. Since the turbine, compressor and generator are mounted on a single rotating shaft, they rotate at the same speed to produce electrical power while continuously drawing in air to maintain the overall process. The faster the shaft spins in the magnetic field, the more electrical output is achieved by the generator. Output power conditioning is obtained using inverter based power electronics.

The electrical supply has enabled BAS to operate about 80% of Halley's normal experiment schedule with no human intervention required. Data is sent via satellite back to scientists' laptops in the UK. The installation of the C30 has already helped to power the station's Dobson photospectrometer.

www.capstoneturbine.com